REDACTED VERSION

Exhibit 18

EXPERT REPORT
of
HENRY S. FARBER
In Connection With

Chen-Oster v. Goldman Sachs
January 15, 2021

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I. Introduction

A. Qualifications

1. I am the Hughes-Rogers Professor of Economics at Princeton University, where I have served on the faculty since 1991. I served on the faculty of the Department of Economics of the Massachusetts Institute of Technology from 1977 through 1991. I received a Ph.D. in economics from Princeton University in 1977, a Master of Science in Industrial and Labor Relations from Cornell University in 1974, and a B.S. in economics from Rensselaer Polytechnic Institute in 1972. Among other topics, I teach courses in labor economics (the analysis of wages, hours, employment, unemployment, labor unions, and other topics related to the workforce) and econometrics (the application of statistics to problems in economics). I have written numerous scholarly articles in both of these subject areas, and my research has been widely published in academic and professional journals. I am a Research Associate of the National Bureau of Economic Research (NBER) and a Research Fellow of the Institute for the Study of Labor (IZA). I am a Fellow of the Econometric Society, a Fellow of the Society of Labor Economists, and a Fellow of the Labor and Employment Relations Association. I am a member of the Labour and Income Statistics Advisory Committee of Statistics Canada. A complete description of my qualifications is contained in my curriculum vitae and a list of my recent testimony is attached as Appendix A to this report. I have also consulted and testified as an expert witness in numerous cases involving labor economics.

2. My time is being billed at the rate of $850 per hour for my work in this matter. This is my normal hourly rate for this type of work. Payment to me is not contingent on my opinions in

this matter. I reserve the right to supplement this report if and when additional, relevant material becomes known to me.

B. Assignment

3. I have previously submitted several reports and declarations in this case.[1] In this report, I review additional data provided by Goldman Sachs since the filing of my most recent reports and declarations (in 2014 and 2018, respectively).

4. I understand that the plaintiffs in this matter are a class of women at Goldman Sachs & Co. and The Goldman Sachs Group, Inc. (together "Goldman" or "Goldman Sachs"). The class consists of female financial-services employees who are or have been employed by Goldman as Associates or Vice Presidents in revenue-generating positions at any of its offices located within the United States as of September 10, 2004 and/or at Goldman's New York office as of July 7, 2002.[2]

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[1] Expert Report of Henry S. Farber in Connection with Chen-Oster v. Goldman Sachs, October 30, 2013; Addendum to the October 30, 2013 Expert Report of Henry S. Farber in Connection with Chen-Oster v. Goldman Sachs, December 3, 2013; Expert Rebuttal Report of Henry S. Farber in Connection with Chen-Oster v. Goldman Sachs, January 28, 2014; Expert Report of Henry S. Farber in Connection with Chen-Oster v. Goldman Sachs, February 17, 2014 ("Original Class Certification Report"). Supplemental Expert Report of Henry S. Farber in Connection with Chen-Oster v. Goldman Sachs, February 17, 2014; Expert Rebuttal Report of Henry S. Farber in Connection with Chen-Oster v. Goldman Sachs, July 29, 2014 ("Class Certification Rebuttal Report"). Second Expert Rebuttal Report of Henry S. Farber in Connection with Chen-Oster v. Goldman Sachs, May 19, 2014. Declaration of Henry Farber in Connection with Chen-Oster v. Goldman Sachs, June 6, 2018, UPDATED June 29, 2018; Declaration of Henry Farber in Connection with Chen-Oster v. Goldman Sachs, June 29, 2018.

[2] Second Amended Class Action Complaint, H. Christina Chen-Oster, Shanna Orlich, Allison Gamba, and Mary De Luis v. Goldman Sachs & Co. and The Goldman Sachs Group, Inc., August 3, 2015 (the "complaint"), ¶¶ 60-62.

5. I have been asked to analyze data concerning employees in revenue-generating positions located within three of Goldman's divisions: Investment Banking ("IBD"), Investment Management ("IMD"), and Securities (which consists of Fixed Income, Currency and Commodities ("FICC") and Equities ("Equities")).

6. Counsel for plaintiffs asked me to study:

a. Whether there is statistical evidence of a difference in compensation between members of the class and their male comparators.

b. To the extent that I find statistical evidence of a difference in compensation between members of the class and their male comparators, how much of this difference in pay can be explained by differences between how men and women fare in Goldman's performance review system.

c. Whether there is statistical evidence of a difference in how men and women fare in Goldman's performance review system.

d. Whether there is statistical evidence of a gender pay gap after Goldman changed the 360 review-scoring from quantitative to qualitative in 2016.

e. Whether there is statistical evidence of disparities between men and women in promotion rates from Vice President positions to positions as Managing Directors.

f. To estimate damages associated with gender disparity in pay at Goldman, both for the pay gap as a whole, as well as for the portion that

is associated with differences in performance review scoring between men and women.

g. To estimate damages associated with gender disparity in promotion to Managing Director.

II. Summary of Opinions

7. My opinions are set forth in my prior Reports,[3] my deposition testimony, and herein, and are summarized as follows:

8. Women are paid less than otherwise similar men, on average, and the difference in pay is statistically significant. I calculate that the average pay difference is 5.1 or 3.5 percent for Associates (depending respectively on whether or not I control for each worker's Business Unit) and 22.4 or 21.5 percent for Vice Presidents (again, depending respectively on whether or not I control for each worker's Business Unit) when I adjust for differences between men and women in tenure (and the square of tenure) at Goldman, related prior experience (and the square of related prior experience), division, Affirmative Action ("AA") job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employee is a new lateral hire, year, and, in some specifications, each worker's Business Unit. [4]

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[3] *See* fn 1, above.

[4] As described in my Class Certification Rebuttal Report, it may be inappropriate to include Business Units in my pay analyses. The reasons for this decision were that Business Unit assignments are within Goldman Sachs' control and thus are a potentially tainted variable (Farber Rebuttal Report, January 28, 2014 at ¶ 113), and that Business Units and the populations that work within them are unstable (Farber Rebuttal Report, January 28, 2014 at ¶ 114). In addition, Goldman did not provide a way to identify Business Units in two divisions prior to 2004, so it is not possible to estimate a model with Business Unit for all relevant years. However, I have seen

9. I have estimated damages associated with the gender difference in pay for women and men after controlling for the variables listed above. These damages are $45.8 million for Associates and $1.26 billion for Vice Presidents.

10. From 2002 through 2015, women are evaluated lower on the 360-degree review and are less likely to be ranked in the top quartile than otherwise-similar men. Those differences are statistically significant and adverse to women.

11. Among Associates, women are paid less on average than men even when they are in the same quartile grouping, for all but the lowest-ranked fourth and fifth quartiles. These differences are statistically significant for all but the bottom quartile grouping. Among Vice Presidents, women are paid less on average than men even when they are in the same quartile grouping, for all quartiles. Among Vice Presidents, these differences are statistically significant and adverse to women in every quartile.

12. Among Associates, there are remaining pay differences after controlling for performance reviews between similar men and women of approximately 3.2 or 1.6 percent, depending respectively on whether or not I control for Business Units.[5] The remaining pay differences among Associates after controlling for performance are statistically significant when I do not control for Business Unit, and are not significant when I do. Among Vice Presidents, there

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some documentary support that Business Units are a locus of decision-making in regards to compensation decisions (see fn 67, below). I have performed versions of many of the compensation analyses in my report that include Business Unit controls (where appropriate), and find that the inclusion of Business Unit as a control variable makes no qualitative difference to my conclusions. Because Business Unit data are not available for the entire time period, I do not estimate damages using a model that includes Business Units.

[5] All of the analyses discussed in this paragraph also include the controls listed in ¶8, above.

are remaining pay differences after controlling for performance reviews between similar men and women of approximately 19.9 or 18.6 percent, depending respectively on whether or not I control for Business Units. The remaining pay differences among Vice Presidents after controlling for performance are statistically significant whether or not I control for Business Units.

13. Among Associates, differences between women's and men's quartile and 360-degree review ratings explain approximately 38.9 or 55.8 percent of the observed pay difference, depending respectively on whether or not I control for Business Units. Among Vice Presidents, differences between women's and men's quartile and 360-degree review ratings explain approximately 13.5 or 15.1 percent of the observed pay difference, depending respectively on whether or not I control for Business Units.

14. I have estimated the back-pay damages associated with the proportion of the gender difference in pay for women that are explainable by the differences in performance reviews. These estimated damages are $17.8 million for Associates and $170.2 million for Vice Presidents.

15. I have compared the gender pay gap for years 2015 and earlier to the gender pay gap in subsequent years. The years from 2016 on correspond to a time period when Goldman has updated its 360 review system to eliminate quantitative performance review scores. I find that the gender pay gap for Vice Presidents did not decrease after this transition.

16. One cannot expect an existing pay gap to disappear even if gender disparities in the rating system are removed. In order to close the pay gap among Vice Presidents, Goldman would need to correct for the degree to which those current pay values reflect past discrimination. I have estimated the total value of raises to female Vice Presidents necessary to bring women to pay parity with male Vice Presidents. In order to close the entire pay gap would require raises in the

current time frame to female Vice Presidents totaling $67.8 million. In order to close the portion of the pay gap that is due to differences in performance review systems would require raises in the current time-frame to female Vice Presidents totaling $9.2 million.

17. Comparing male and female Vice Presidents, I find that during the period 2003 through 2018, fewer women were promoted than one would have expected had women been promoted at the same rate as men with the same observed characteristics. Comparing men and women Vice Presidents in the same year with the same number of years as Vice President and also adjusting for differences in division, office, education, experience at Goldman, experience at Goldman squared (both from the most recent hire date), relevant experience prior to most recent date at Goldman (including experience in prior employment spells at Goldman), relevant prior experience squared, Business Unit, and whether a direct hire into the VP position, women experienced 25 fewer promotions than I would expect in the absence of discrimination. This difference is statistically significant and adverse to women.

18. I have calculated the damages associated with the gender difference in promotions from Vice President to Managing Director for women and men after controlling for the variables listed above. This difference is $170.9 million.

III. Background

19. In this section of my report, I briefly discuss areas of background information relevant to my analysis. I first provide a short introduction to those divisions of Goldman that are included in my analysis. I then summarize the components of earnings for Associates and Vice Presidents

at Goldman. I also describe Goldman's firm-wide review process. Next, I lay out Goldman's promotion policies. Finally, I provide an introduction to my data sources.

A. Divisions

20. My analysis includes financial-services employees who work in revenue-generating positions located within three Goldman divisions: Investment Banking ("IBD"), Investment Management ("IMD"), and Securities (consisting of Fixed Income, Currency and Commodities ("FICC") and Equities ("Equities")). I understand that these divisions have the following goals, as described on the Goldman website.[6]

21. IBD works with corporate clients, pension funds, financial institutions, asset managers, entrepreneurs and governments to structure and execute financing and risk management transactions.[7]

22. IMD provides investment management services and offers investment products across all major asset classes to institutional and individual clients. It also offers wealth advisory services, including portfolio management and financial counseling, and brokerage and other transaction services to high-net-worth individuals and families.[8]

23. Securities deals with interest rate products (such as government bonds, treasury bills and other highly liquid instruments), credit products, mortgages, currencies, commodities, and

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[6] https://www.goldmansachs.com/careers/divisions/. Accessed November 13, 2020.

[7] https://www.goldmansachs.com/careers/divisions/investment-banking/index.html. Accessed November 13, 2020.

[8] https://www.goldmansachs.com/careers/divisions/consumer-and-investment-management/index.html In 2019, IMD was renamed the "Consumer and Investment Management Division" or "CIMD". (See Declaration of Kathleen Cupertino, November 12, 2020 ("Cupertino Declaration") at fn. 1.

stocks and other equity-related products (such as convertible securities, options and futures) and provides other services for institutional investors.[9]

24. Each of these three divisions is comprised of Business Units.[10] I have identified Business Units based on declarations from Goldman employees.[11] There are between 26 and 79 Business Units in each year,[12] with the Securities Division having the most distinct units over time, and the IMD Division having the fewest.

B. Compensation

25. Goldman's Compensation Recommendation System ("CRS") records and maintains a variety of information, including employee earnings during the relevant time frame. Employee compensation is set by senior management at Goldman through common, firm-wide processes. An employee's earnings for Associates and Vice Presidents typically consist primarily of a salary as well as the year-end bonus. Total earnings, including the base salary and bonus (which can include both cash and equity),[13] are referred to as "Per Annum Total Compensation" (PATC).[14]

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[9] https://www.goldmansachs.com/careers/divisions/global-markets/index.html. In 2020, the Securities Division was renamed the Global Markets Division (See Declaration of Jacqueline Cassidy, October 19, 2020 ("Cassidy Declaration"), at fn. 1).

[10] For instance, Investment Banking contains Business Units organized by product, including Leveraged Finance, Structured Finance, and Equity Capital Markets, or industry, including Industrials Consumer Retail, and Technology/Media and Telecommunications. *Opinion and Order, Chen-Oster et al., v. Goldman Sachs* 10-cv-06950-AT-RWL at p. 5

[11] Declaration of Joanna Kozlowski, November 28, 2020 ("Kozlowski Declaration") at ¶¶ 4-5 (IBD); Cupertino Declaration at ¶¶ 6-7 (IMD); Cassidy Declaration at ¶¶ 5-8 (Securities).

[12] Beginning in 2004, the first year that the Kozlowski, Cupertino, and Cassidy Declarations provide guidance for determining Business Unit in all divisions.

[13] GS0274507 at -512; GS0116944 at -951.

[14] Deposition of Stephanie Blinder ("Blinder Tr."), April 30, 2013, at 150:12.

26. Base salary increases in the current year are determined, in part, by prior year PATC.[15] Because each worker's current pay is determined, at least in part, by his or her prior year's compensation, a pay difference in year one will carry over to year two and onwards, if not corrected by deliberate adjustment. This is a mechanism by which gender pay differences can persist until corrected.

C. 360-degree Performance Review and Manager Quartiling.

27. Goldman employs a performance evaluation system that consists of a 360-degree performance review and a manager quartiling process.

28. For the 360-degree performance review, each employee is evaluated by his or her manager and a number of other Goldman employees who are generally a combination of more senior, less senior, and peer reviewers.[16] Reviews are both solicited and unsolicited.[17]

29. Each reviewee is scored on nine "Firmwide Review Categories": Technical Skills, Communication Skills, Judgment/Problem Solving, Teamwork, Compliance, Diversity, Leadership, Overall Commercial Effectiveness, and Overall Professional Performance.[18] These nine items were combined to form the 360 review score.

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[15] See, for instance 2007 Detailed Compensation Communication Guide for HCM which describes [redacted] (GS0113786 at -91. See also, GS0122847 [redacted]

[16] GS0098769.

[17] Deposition of David Landman ("Landman I Tr."), September 5, 2013 at 62:19-63:13. Employees are encouraged to have between 8 and 12 reviewers. GS0119395. The number of reviewers changed to 6 in 2016. GS0455429, GS0982621 at 622.

[18] GS0003383 at -387; GS0120172 at -177; Deposition of Jessica Kung ("Kung Tr."), August 1, 2013, at 305:14-18, 307:2-8; GS0120195 at -209 (Exhibit 233); GS0121383 at -388; GS0120828 at -833; GS0110583 at -591; GS 0110603 at -611.

30. Through 2009, each criterion was scored on a scale from 1 to 5.[19] During the period 2010-2015, this scale was expanded to be from 1 to 9.[20] However, through 2009, over 99% of the overall 360 scores were 3 or higher, and during the period 2010-2015 all of the overall 360 scores were above 5 and over 98% were 7 or higher.[21]

31. In 2016, this system was revised so that numerical scores were eliminated.[22] Instead, the 360 review process solicits comments for each employee in the form of two questions: "What are this person's top strengths?" and "What is at least one thing this person should consider doing differently?"[23] All Associates and Vice Presidents are also assigned a manager's overall rating of either "Outstanding," "Good, " or "Needs Improvement."[24]

32. Prior to 2016, 360-scores were typically adjusted to account for the "harshness" or "leniency" of individual reviewers so long as there is sufficient data to do so. The maximum adjustment is +/- 0.25 points.[25]

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[19] Kung Tr. at 290:16-291:11

[20] Kung Tr. at 314:21-25.

[21] See my workpapers.

[22] Declaration of David Landman, October 13, 2017 ("2017 Landman Declaration") at ¶ 6.

[23] 2017 Landman Declaration at ¶ 7. These questionnaires also direct the reviewer to "designate the categories to which his or her answers to these questions are relevant. The categories include client focus, commercial contributions, culture carrier, risk management/firm reputations, and judgment, among others." (2017 Landman Declaration at ¶ 7).

[24] 2017 Landman Declaration at ¶ 11.

[25] GS0003383 at -385. A Goldman witness testified that the fundamentals of the adjustment process remained unchanged when Goldman transitioned from a 5-point score to a 9-point score. Deposition of David Landman ("Landman II Tr."), October 10, 2013, at 184:7-18. After 2016, the 360 scores are no longer quantitative and as such, no adjustment is performed.

33. The 360-degree performance review score is a stated input into the managers' quartiling decisions.[26] There are a number of other inputs into the quartiling process in addition to the 360-degree score, such as: "quality of performance," "long-term commercial impact or contribution," "potential to assume increasing responsibility," "leadership/management skills," and "diversity and citizenship activities."[27] A representative for Goldman Sachs describes 360 Scores as "no longer an input" after the redesign of the 360 review process to use qualitative rather than quantitative ratings in 2016.[28] However, a number of documents and record evidence indicate that the 360 continues to be an input into the manager quartile.[29]

34. The manager quartiling process is an assessment tool that Goldman Sachs uses to evaluate the relative performance of its employees and to set compensation.[30] The managers are required, as part of the quartiling process, to distribute employees into four or five "quartiles" based on perceived relative performance.[31] This requirement is sometimes known as "forced ranking."[32] Quartiling has been used at Goldman Sachs throughout the Class Period.[33] The

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[26] GS0153476 at -480.

[27] GS0153476 at -480.

[28] 2017 Landman Declaration at p. 8, heading "Changes to the Manager Quartiling Process; 360 Scores Are No Longer and Input."

[29] GS0484728; GS0637321; GS0637303 at -304; GS0440622; GS0456223. See also deposition of Anilu Vasquez-Ubarri at 131:4-132:13 (testifying that 360 reviews are one input into compensation decisions).

[30] Landman II Tr. at 8:7-9.

[31] Note that though Goldman refers to these groups as "quartiles," they are not always quartiles in the usual sense of the word—four equally-sized groups. For most the time period I study, there are five "quartiles", with two middle "quartiles" combined in some years.

[32] GS0153476 at -478, -485.

[17] Landman Tr. at 8:10-15.

quartile was also called "Manager Performance Rank" for a portion of the Class Period; the terms are synonymous.[34]

35. Managers were instructed to assign employees into quartiles 1 through 5, with the first quartile comprising about 25% of the top performing employees by rank, the second quartile comprising the next best 25% of the employees (25th to 50th percentile) by rank, the third quartile comprising (approximately) employees in the 50th to 75th percentile by rank,[35] the fourth quartile comprising the next 15% of employees by rank (75th through 90th percentile) and the fifth quartile assigned to the bottom 10% of the employees by rank.[36] As of 2015, there are no longer five "quartiles," and each of the four quartiles each represent approximately 25% of the population for each Division.[37] Additionally, beginning in 2015, the 25% per-quartile distribution can vary by up to 2% with "no questions asked," a formalization of a prior "soft shoulder" approach to quartiling.[38]

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[18] GS0153476 at -480.

[35] In the Securities division from 2007 through 2010, in the IBD division from 2007 through 2014, and in the IMD division from 2007 through 2011, employees in the 2nd and 3rd quartile are grouped into a single "2/3 quartile" grouping.

[36] GS0153476 at -478.

[37] 2017 Landman Declaration at ¶ 26.

[38] 2017 Landman Declaration at ¶ 27.

D. Promotions

36. In order to evaluate candidates for promotions from Vice President ("VP") to Managing Director ("MD", also referred to as Extended Managing Director), Goldman Sachs uses a process known internally as "cross-ruffing."[39]

37. Goldman generates a list of candidates to be considered for promotion. From 2002-2007, the firm maintained a website where any current MD or Participating Managing Director ("PMD") could nominate a VP for consideration.[40] Beginning in 2008, the process was modified so that division and regional heads submitted candidate lists to Human Capital Management ("HCM").[41] The final list of candidates is submitted to a firm-wide committee for review.[42]

38. The HCM team proposes a selection committee (known as a "cross-ruffing committee").[43] The committee's composition is finalized by senior divisional leadership, and is approved by a firm-wide committee.[44] Each member of the cross-ruffing committee is assigned a list of candidates to review.[45] For each candidate, the reviewer interviews MDs who are knowledgeable about the candidate, then prepares a one-page summary review sheet.[46] After the

[39] GS0113548 at -556; Deposition of Caroline Heller-Sberloti ("Heller-Sberloti Tr."), July 10 & 11, 2013, at 213:25-214:8.

[40] GS0113548 at -564, GS0004990 at -009.

[41] GS0004777 at -779; Heller-Sberloti Tr. at 232:4-233:9.

[42] Deposition of Bruce Larson ("Larson Tr."), June 12, 2013, at 229:6-21 and 232:8-11; Kung Tr. at 415:23-416:2; Heller-Sberloti Tr. at 205:18-23.

[43] Kung Tr. at 399:8-24; Larson Tr. at 240:10-21; Heller-Sberloti Tr. at 214:9-215:4.

[44] Kung Tr. 399:25-400:21; Larson Tr. at 240:10-21; Heller-Sberloti Tr. at 213:5-12.

[45] Kung Tr. at 440:2-9; Larson Tr. at 243:1-4 Heller-Sberloti Tr. at 218:10-13.

[46] GS0113548 at -552 and -556. Blank review sheet at -560.

reviews are completed, the committee ranks the list of candidates in order of preference for promotion. [47] The division heads then review this list and create their own ranked list.[48] Both lists are submitted to the firm-wide executive office for review and approval.[49] Goldman's Management Committee decides how many people each division may promote each year, and finalizes the list of ranked candidates in conversation with both the division leaders and the leaders of the cross-ruffing committee.[50]

39. There is no requirement that a Vice President attain a certain quartile ranking in order to be eligible for promotion to Managing Director.[51] However, manager quartile is considered in deciding who will be a candidate for promotion.[52]

40. Beginning in 2015, Goldman moved from promoting individuals from Vice President to Managing Director on an annual basis to making these promotions only in every other year.[53]

E. Data

41. Goldman made a number of data files available to me, of which I have used:

- extracts from Goldman's PeopleSoft database,
- extracts from the Compensation Recommendation System ("CRS") database,

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[47] GS0113548 at -566; Larson Tr. at 244:14-20.

[48] GS0113548 at -567; Larson Tr. 246:25-247:3.

[49] Larson Tr. at 247:24-248:8; Kung Tr. at 453:13-23; Heller-Sberloti Tr. at 230:6-9; GS0164972; GS0242506.

[50] Larson Tr. at 248:16-149:4; Kung Tr. at 452:19-454:16; Heller-Sberloti Tr. at 230:10-231:19.

[51] Kung 428:8-429:20; Larson Tr. at 296:16-297:17; GS0436916 at -18.

[52] GS0969081; GS0528005, GS0434084; GS0487959.

[53] GS0627184.

- extracts from the Firm-Wide Review System ("FRS") database.
- extracts from EMD Candidate List[54]

42. Extracts from the PeopleSoft database contain (among other fields) data on an employee's job history while being employed at Goldman, including employee's job title, gender, date of hire at Goldman, date an employee became a Vice President, date an employee became a Participating or an Extended Managing Director, and changes in the employee's status throughout the course of a fiscal year. [55] The PeopleSoft data also provide information about an employee's personal characteristics such as work experience prior to the current period of employment at Goldman, education, degree, degree description and the date the degree was granted. The PeopleSoft data indicate the type of leave an employee may have taken over the course of a year (FMLA, Maternity, Sick, Personal, Disability, etc.).

43. It is my understanding that prior to 2009 Goldman's fiscal year did not coincide with a calendar year; e.g., Goldman's 2007 fiscal year started on December 1 of 2006 and ended on November 30, 2007. In 2009 Goldman changed this practice by switching to a calendar year definition of the fiscal year. Thus, Goldman's 2009 fiscal year ran from December 1, 2008 through December 31, 2009, and Goldman's 2010 fiscal year ran from January 1, 2010 through December 31, 2010.[56,57]

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[54] This list is described in ¶ 37, above.

[55] Employee status can take the values "Active," "Retired," "Terminated," "Leave of Absence," "Leave with Pay," or "Deceased."

[56] Correspondence from Rebecca Farber, March 19, 2013.

[57] Note that because of a change in computer systems in 2004, Goldman provided PeopleSoft data for periods prior to September 1, 2004 only for workers who continued to work at Goldman after

44. The CRS extracts contain (among other fields) information on an employee's year-end earnings (base salary and year-end bonus), job group, and location. In this report I make use of Quartile data derived from CRS.

45. The FRS extracts contain (among other fields) information on the employee's adjusted and unadjusted average 360-score, an employee's average cumulative 360-score used for ranking, review groups for the employee, both regional and global, employee's rank within his or her group, and the number of people in the review group. I understand that 360-degree performance reviews took place twice a year during the summer and the winter with the majority of the employees being reviewed during the summer cycle. Where an employee has two reviews in the course of the year, I have used the summer 360-score and quartile for that individual. Goldman made FRS data available for years 2003 through 2015 for the summer reviews and for years 2004 to 2015 for the winter reviews.

46. Beginning in 2016, Goldman moved from the quantitative 360 score process to a qualitative 360 performance review score, with scores that take three categories, "Outstanding," "Good," and "Needs Improvement." Goldman provided FRS data for these scores for years 2016 to 2018.

47. My compensation measure is based on total cost earnings for an individual that measure total year-end compensation.[58] Through 2011, I use a field in the CRS database called

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that date. Employees who separated from Goldman prior to September 1, 2004 are not included in the data even if they worked at Goldman prior to September 1, 2004 and would otherwise have been included.

[58] As described in Blinder Tr. 151:11-152:17

"Total Cost for Equity Calculated Amount."[59] I then convert this measure to an annualized basis to account for part-year employment. Beginning in 2012, I use a field called "PATC USD (FY) (FX - Current)," that reports annualized compensation directly.

48. To identify those VPs that were promoted, I use two methods. In 2003-2011, prior to Goldman's provision of EMD Candidate Lists, I identify promoted VPs as those whose title changes from VP in one year to EMD in a subsequent year. Beginning in 2012, I use extracts from the EMD Candidate List, which identifies promotions directly.[60]

IV. Methods

49. In this section of my report, I provide a general description of my methods for testing for the presence of discrimination in Goldman's systems. The methods I apply are standard among labor economists.

50. Economists define sex discrimination in pay to be differences in pay between men and women that cannot be explained by differences in personal characteristics like education and work experience or differences in the type of work they perform.[61]

51. An individual's education and work experience are related to his or her pay. Workers who are better educated earn more than those with less education, on average. Similarly, more experienced workers have higher average pay than workers with less experience. These

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[59] Sheet "Equity Compensation" in Compensation_2_Feb.13.2013.xlsx (CRS)

[60] No EMD promotions took place in 2014, 2016, or 2018.

[61] Note that these "personal characteristics" are characteristics that the employee brings to the job and, as a result, are not influenced by Goldman's employment practices. They are distinct from the performance measures developed by Goldman, which I discuss in Section VI of my report.

differences reflect the increase in productivity that is associated with additional education or work experience.

52. Average pay also varies across types of jobs, even for workers with otherwise similar characteristics. In studying the salaries of male and female employees at Goldman, I have adjusted for differences between them in education, relevant work experience prior to the current employment spell with Goldman, time at Goldman, whether or not the employee was a lateral hire into his or her current role, whether a lateral hire is in their first year of employment at Goldman, and the type of work performed, as identified by each worker's AA job group.[62] I also control for fiscal year, which adjusts for differences in pay over time, and I control for the city in which an employee works. Additionally, I control for the division in which each employee works, and in some specifications, I also control for each worker's Business Unit (a subclassification of division).

53. The key statistical technique I use is multiple regression analysis of pay. A multiple regression analysis yields an estimate for each factor of its impact on pay. These estimates are called the coefficients of the model.

54. While the factors listed in the previous paragraph are the central systematic factors that determine pay in a non-discriminatory compensation system, there is substantial variation in pay

[62] To allow for a non-linear relationship between experience and pay, my models include both work experience and the square of work experience both at Goldman and prior to the current period of employment at Goldman. I have also created a category of education that identifies and controls for workers for whom the highest level of education is missing. This is approximately 2.5% of employee-year observations.

that is not accounted for by these factors. The multiple regression model accounts for these unmeasured factors through a random component.

55. The coefficients of the model are estimated using multiple regression analysis, and these estimated coefficients are used to compute a prediction of pay for each worker based strictly on the factors included in the model. Estimates of the unmeasured factors are then computed as the difference between the actual pay level and the predicted pay level. This difference is called the residual.

56. If pay is determined in a non-discriminatory fashion, then these residuals will not be systematically related to the sex of the worker. If there is a systematic relationship such that women are paid less, on average, than predicted by the factors included in the model, then I would conclude that the analysis provides statistical evidence of discrimination.

57. The actual calculation is done in a single step by including in the model a variable that indicates which observations relate to women. The central result of the multiple regression analysis in this case is an estimate of the effect of being a woman on pay, accounting for differences between men and women in the other factors included in the model. The estimated effect of being a woman on pay in this model is a measure of the relationship between sex and the unmeasured factors affecting compensation. If it is found that there is a statistically significant negative effect of being a woman on pay (an effect that was unlikely to have arisen by chance) after accounting for differences in the workers' characteristics and job characteristics included in the model, then I conclude that there is statistical evidence of discrimination against women in pay.

58. In order to draw an inference that there has been discrimination, it is important to determine how likely it would be to find the observed difference in pay if there had not been discrimination. To make this clear, consider the following example. Suppose that, in fact, pay is non-discriminatory so that, all other things equal, men and women would earn the same level of pay. However, there are many factors that affect pay in any particular case. Some of these, such as education, experience, and job group, are measurable and appropriate to consider in pay determination. Others are not measured and assumed to be the same, on average, for men and women. These unmeasured characteristics are captured by the random component.

59. What this means is that, for any group of men and women who are paid on a non-discriminatory basis, there will be some average difference in pay due to variation in the random component even after accounting for individual and job characteristics. The multiple regression analysis provides a measure of how likely it is that the estimated average difference in pay accounting for the included factors is due to random variation (which is assumed equal on average for men and women) rather than to systematic variation in pay by sex (discrimination).

60. A statistic provided by the multiple regression analysis is called a "t-ratio" (sometimes called the “number of standard deviations”) on the estimated coefficient in the pay regression on the variable indicating being a woman (the average difference in pay between women and men accounting for the other factors). Larger absolute values of the t-ratio indicate that the estimated pay difference is less likely to have occurred by chance. The usual standard used by labor economists for a conclusion that an estimated pay difference is statistical evidence of discrimination is a t-ratio greater than 1.96 (in absolute value), which indicates that the observed

difference would have occurred randomly in the absence of discrimination less than five percent of the time.

V. Analysis of Earnings

61. In this section, I describe my analysis of differences in pay between men and women who were Associates or Vice Presidents at one of Goldman's US offices from 2005 through 2018 or those who were Associates or Vice Presidents at Goldman's New York office starting in 2003 or 2004.[63] Specifically, I include controls for work experience in related areas prior to working at Goldman (and its square), direct hires into Associate and Vice President positions (also called lateral hires),[64] division, year, office, education, affirmative action ("AA") job group, experience at Goldman, and experience at Goldman squared (both from the most recent hire date).[65]

62. I use the AA job group classification, which is reported to the Office of Federal Contract Compliance Programs within the United States Department of Labor (OFCCP), to account for broad differences in the type of work performed. This classification system is described by the United States Department of Labor Code of Federal Regulations, Title 41 – Public Contracts and Property Management. §60-2.12(b) states:

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[63] While the class periods for the New York class and the national class begin in mid-year 2002 and 2004 respectively, I limit my analysis to those years for which all earnings are in the relevant period of time.

[64] My controls for direct hires include indicators (separately for Associate and Vice Presidents) for whether the relevant individual was directly hired at the beginning of his or her current period of employment and an additional indicator for whether the current year is the first year of that period of employment.

[65] I combine offices with fewer than 100 person-year observations, and AA job groups with fewer than 150 observations into single "other" office and AA job group categories, respectively.

> In the job group analysis, jobs at the establishment with similar content, wage rates, and opportunities, must be combined to form job groups. Similarity of content refers to the duties and responsibilities of the job titles which make up the job group. Similarity of opportunities refers to training, transfers, promotions, pay, mobility, and other career enhancement opportunities offered by the jobs within the job group.[66]

63. By accounting for AA job group, I am relying on Goldman's own classification of job groups that are broadly comparable in the dimensions that are relevant for the compensation analysis. Workers within a job group have been classified by Goldman to have similar duties, responsibilities, compensation opportunities, and promotion opportunities for purposes of their reporting to the relevant federal reporting agency, the OFCCP.

64. In some analyses, I also control for each worker's Business Unit. Recently, representatives for Goldman described in a series of affidavits how to identify Business Unit for each Division at issue in this case.[67] However, these affidavits only identify Business Units consistently across all three divisions beginning in 2004. Therefore, when I perform analyses that include Business Unit controls, I begin these analyses in 2004.[68]

65. I perform all of my analyses separately for Vice Presidents and Associates.

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[66] https://ecfr.federalregister.gov/current/title-41/subtitle-B/chapter-60/part-60-2/subpart-B/section-60-2.12. Accessed November 17, 2020.

[67] The Cupertino Declaration describes the process for identifying Business Units at IBD beginning in 2004. The Cassidy Declaration describes the process for identifying Business Units in Securities beginning in 2004. The Declaration of Joanna Kozlowski, November 18, 2020 (Kozlowski Declaration) describes the process for identifying Business Units in IBD beginning in 2003.

[68] I begin the analyses that do not include Business Units in 2003. I also combine Business Units with fewer than ten person-year observations into a single "other" Business Unit category

66. In this section, I present analyses that do not include measures of performance (quartile and 360 review score) as well as analyses that include these measures. This is important because gender bias in the performance measures (overall 360 scores, and manager quartiles) is part of the plaintiffs' allegation of gender discrimination.

67. I present basic summary statistics for the data I analyze in Tables 1 and 2. These summary statistics provide an introduction to the data, and I do not draw any conclusion from them. These data are based on the sample I use for my primary regression analysis, and they exclude person years with missing data for the factors included in my regression analyses.[69]

68. In the top panel of Table 1, I display the number of individuals and person/years by gender, for associates. It shows that approximately 28% of person-year observations among Associates are women. The bottom panel of Table 1 contains the same information for Vice Presidents. This shows that approximately 22% of person-year observations among Vice Presidents are women.

69. I report data on average earnings in Table 2. The top panel presents data on average earnings for Associates; the bottom panel presents data on average earnings for Vice Presidents. This Table also contain data on the average natural logarithm ("log") of annualized earnings. These data, like all earnings data analyzed in my report, are annualized (converted to a full-year equivalent level) to take account of part-years caused by unpaid leaves and by hires that have occurred at some point during a fiscal year. The table shows mean earnings and mean log

[69] Among observations for which I have compensation information, 0.7% are dropped from the analysis file because of missing data.

earnings for men and women separately. I also report the standard deviation of earnings and log earnings. A standard deviation is a commonly used measure of the degree of variation in the data. The data in the table indicate that, on average, men earn more than women with the mean earnings for male Associates being approximately $277,899 while the mean earnings for female Associates is approximately $244,135. Among Vice Presidents, men earn approximately $707,841 per year on average and women earn approximately $495,802 per year on average.

70. I present the results of my first analysis of pay differences in Tables 3 and 4. Table 3 contains estimates for the gender difference in pay (in natural logarithms) among Associates. Table 4 contains estimates for the gender difference in pay (in natural logarithms) among Vice Presidents. I report the average logarithmic pay difference in the first column of the table after adjustment for the factors included in the relevant model. Negative differences indicate that women earn less on average than men who are otherwise the same in terms of the characteristics included in the model. I report the absolute value of the t-ratio for each logarithmic difference in Column 2 of the table. Generally speaking, values for the t-ratio of 1.96 or higher indicate that the logarithmic difference is statistically significant at the 5 percent significance level.[70] In Column 3 of the table, I report the value of the percentage difference in pay calculated from the logarithmic difference in pay.

71. The first row of each table, labeled "Model 1", presents results from a model that makes no adjustments for differences between Associates (Table 3) or Vice Presidents (Table 4),

[70] I calculate these t-ratios using Huber-White robust standard errors clustered by individual to allow for the possibility that observations on the same individual in different years are not statistically independent of one another.

other than their gender. I present this model as a reference point for the other models and draw no conclusions from the results of Model 1. This analysis shows that, without adding any controls, female Associates earn 6.8 log points (6.6%) less than male Associates, and female Vice Presidents earn 29.6 log points (25.6%) less than male Vice Presidents.

72. The second row, labeled "Model 2", controls for division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared (both from the most recent hire date), relevant experience prior to most recent date at Goldman, relevant experience squared, whether a direct hire into the Associate or VP position and an indicator for the fiscal year being the year of hire for those hired into Associate/VP positions directly.

73. I additionally include a version of this analysis which also controls for Business Unit, in addition to the other "Model 2" controls described above. The results of this analysis are reported in the third row of Tables 3 and 4, and are qualitatively similar to those from Model 2, which does not include Business Unit controls.

74. Table 3 indicates that, without adjustments, female Associates earn 6.8 log points (6.6 percent) less than male Associates, on average. When I calculate the pay gap accounting for differences in the factors included in Model 2 (division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared - both from the most recent hire date, relevant experience prior to most recent date at Goldman, relevant experience squared, whether a direct hire into the Associate or VP position and an adjustment for the fiscal year being the year of hire for those hired into Associate/VP positions directly), the gender pay gap for Associates falls to 5.3 log points (5.1 percent). When I additionally control for Business Unit, (Model 3), the pay

gap for Associates is 3.6 log points (3.5 percent). Each of these gender pay gaps is statistically significant at the 5% level, with t-ratios higher than 1.96.

75. Table 4, which presents the results for Vice Presidents, indicates that, without adjustments, female Vice Presidents earn 29.6 log points (25.6 percent) less than male Vice Presidents, on average. When I calculate the gender pay gap accounting for differences in the factors included in Model 2 (division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared - both from the most recent hire date, relevant experience prior to most recent date at Goldman, relevant experience squared, whether a direct hire into the Associate or VP position and an indicator for the fiscal year being the year of hire for those hired into Associate/VP positions directly), the gender pay gap for Vice Presidents falls to 25.4 log points (22.4 percent). When I additionally control for Business Unit, (Model 3), the pay gap for Vice Presidents is 24.3 log points (21.6 percent). Again, each of these gender pay gaps are statistically significant at the 5% level, with t-ratios larger than 1.96.

VI. The Role of Goldman's Performance Rating Systems

A. Gender Differences in Performance Review Quartiles

76. I calculate whether there is statistical evidence of a difference in how men and women fare in the manager quartiling process. I present summary statistics for the performance quartiles in Tables 5 (Associates) and 6 (Vice Presidents). In order to utilize a definition of "quartile" that is consistent across time and divisions, I combine quartiles 2 and 3 into a single category, and I

likewise combine quartiles 4 and 5 into a single category.[71] These data show that women in each job title were less likely than men to be in the top quartile: among Associates, 28.2 percent of men's observations received a top quartile score, as opposed to 25.8 percent of women's observations; among Vice Presidents, 27.4 percent of men's observations received a top quartile score, while 25.6 percent of women's observations received a top quartile score. I have performed a chi-squared test of independence of gender and quartile placement. Among Associates, I find a p-value of 0.012, indicating that there is a significantly significant relationship at the 5% level between gender and quartile placement for Associates. Among Vice Presidents, I find a p-value of 0.002, indicating that there is a significantly significant relationship at the 5% level between gender and quartile placement for Vice Presidents.

77. I have also studied whether differences in top quartile placement can be explained by differences between men and women in terms of the factors included in my model. I report the results of these analyses in Tables 7 (Associates) and 8 (Vice Presidents). The statistical model used here is called a probit model, which is a version of the multivariate model I used for my analysis of pay that is appropriate for cases where the outcome variable takes on two discrete values (in this case, each worker's placement in the top quartile or not). The first row of each table, labeled "Model P1", presents results from a model that makes no adjustments for differences between individuals other than their gender. I present this model as a reference point for the other models and draw no conclusions from these data. The second row, labeled "Model P2", controls

[71] Combining quartiles in this way makes them consistent across all time periods, given that in general, Securities used the combined "2/3" quartile from 2007 to 2010; IBD used it from 2007 to 2014, and IMD used it from 2007 to 2011. All divisions stop using the fifth "quartile" in 2015.

for division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared (both from the most recent hire date), relevant experience prior to most recent date at Goldman, relevant experience squared, and whether a direct hire into the Associate or VP position. The third row, labeled "Model P3" includes the variables in Model P2 and additionally controls for each worker's Business Unit.

78. Column 1 of Tables 7 and 8 contains the estimated coefficient on the female indicator variable from the probit model. A negative coefficient indicates that women are less likely than men to receive a top quartile rating.

79. Column 2 of Tables 7 and 8 contains the t-ratio associated with the coefficient in the first column. As in the linear regression analysis, values for the t-ratio of 1.96 or higher indicate that the female coefficient is statistically significant at the 5 percent significance level, in which case the estimated gender disparity in top-quartile placement is unlikely to be due to chance.

80. In a probit analysis, it is straightforward to interpret the sign of the coefficient, but the magnitude of the coefficient does not have a straightforward interpretation. I estimate the magnitude of the gender difference by using this coefficient to derive a "marginal effect" of being female on the probability of a top-quartile placement. This marginal effect is presented in Column 3 of Tables 7 and 8. The marginal effect is the estimated difference between females and males in the probability of being in the top quartile implied by the estimates of the particular probit model referred to in each row. A negative marginal effect implies the females are less likely to be in the top quartile than males accounting for the factors included in the model referred to in each row.

81. Column 4 of Tables 7 and 8 contain the Z-score associated with the marginal effect. These are interpreted in the same way as the t-ratios used in earlier tables: values of the Z-score

greater than or equal to 1.96 (in absolute value) imply that the marginal effect is statistically significant. This indicates that a non-zero marginal effect would have occurred randomly in the absence of discrimination less than five percent of the time.

82. Table 7 indicates that, without adjustments (model P1), female Associates are 2.4 percentage points less likely than male Associates to be in the top quartile. When I calculate the difference in the likelihood of being in the top quartile accounting for differences in the factors included in Model P2 (division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared - both from the most recent hire date, relevant experience prior to most recent date at Goldman, relevant experience squared, and whether a direct hire into the Associate position), the gender gap in the likelihood of being in the top quartile for Associates increases to 3.1 percentage points. Additionally, controlling for Business Unit (Model P3) changes this gender gap in the likelihood of being in the top quartile to 3.4 percentage points. Each of these gender gaps are statistically significant at the 5% level, with Z-scores higher than 1.96.

83. Table 8, which presents the results for Vice Presidents, indicates that, without adjustments (Model P1), female Vice Presidents are 1.8 percentage points less likely than male Vice Presidents to be in the top quartile. When I calculate the difference in the likelihood of being in the top quartile accounting for differences in the factors included in Model P2 (division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared - both from the most recent hire date, relevant experience prior to most recent date at Goldman, relevant experience squared, and whether a direct hire into the VP position), the gender gap in the likelihood of being in the top quartile for Vice Presidents increases to 3.2 percentage points. Additionally, controlling for Business Unit (Model P3) changes this gender gap in the likelihood

of being in the top quartile to 3.6 percentage points. With the exception of the raw, uncontrolled version (P1), these gender gaps are statistically significant at the 5% level, with Z-scores higher than 1.96.

84. As with the pay analyses reported in Tables 3 and 4, these results are qualitatively similar whether or not I control for Business Unit.

B. Gender Differences in 360 Degree Performance Reviews

85. The 360 review process is rooted in individual reviews of an employee by his or her managers, peers, and subordinates.[72] When I discuss a "360 score" or "360-review" score, it refers to the overall score that is a result of this review process. Goldman stopped reporting numerical 360 scores after 2015.[73] As such, the following analyses refer to the years during which Goldman does report numerical 360 scores.

86. I calculate whether there is statistical evidence of a difference in how men and women fare in the 360 review process. I present summary statistics by year for the adjusted 360-review score in Tables 9 (Associates) and 10 (Vice Presidents). I present these statistics for reference only and draw no conclusions from them. These summary statistics show that for Associates, mean scores are lower for women than for men in every year except 2008, when women's mean 360 scores are the same as men's. For Vice Presidents, mean scores are lower for women than for men in every year.

[72] GS0113317 at -24; Kung Vol. 2 Tr. 278:16-279:12; Landman 2018 Tr. 139:12-140:24 and 152:3-10.
[73] 2017 Landman Declaration at p. 2.

87. I have also studied whether these differences in 360 Degree Review scores can be explained by differences between men and women in terms of the factors included in my model. I report the results of these analyses in Tables 11 (Associates) and 12 (Vice Presidents). Because the scale on which this review was scored changed from a 1 to 5 scale to a 1 to 9 scale after 2009, I report two analyses each for Associates and Vice Presidents, one covering the period from 2003 through 2009, one covering the period from 2010 through 2015.[74]

88. The first model, labeled "Model 360-1", presents results from a model that makes no adjustments for differences between Associates (Table 11) and Vice Presidents (Table 12), other than their gender. I present this model as a reference point for the other model and draw no conclusions from these estimates. The second model, labeled "Model 360-2", controls for division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared (both from the most recent hire date), relevant experience prior to most recent date at Goldman, relevant experience squared, and whether a direct hire into the Associate or VP position. The third model, labeled "Model 360-3" controls for the variables in Model 360-2, and additionally controls for each individual's Business Unit.

89. I report in Table 11 that in both periods, when I control for the factors included in Models 360-2 and 360-3, female Associates score statistically significantly lower on the 360-review than otherwise similar male Associates.

[74] I use a linear regression model here, rather than a probit model, because 360 scores take on a range of values, rather than taking on one of two discrete values (like top quartile versus non-top quartile).

90. I report in Table 12 that in both periods, whether or not I control for the factors included in Models 360-2 and 360-3, female Vice Presidents score statistically significantly lower on 360-review than otherwise similar male Vice Presidents.

91. For both Associates and Vice Presidents, my results are qualitatively similar whether or not I control for Business Unit.

C. Impact of Performance Reviews on Gender Pay Gap

92. Tables 13 and 14 contain summary statistics for pay differences between females and males separately by quartile rank, with Table 13 presenting data for Associates and Table 14 presenting data for Vice Presidents. I present mean earnings by quartile rank for men and for women and also the dollar and the percentage difference in earnings between women and men by quartile rank. These data indicate that among both men and women, those in higher quartiles earn more, on average, than those in lower quartiles. These data also indicate that women earned less than men, on average, in the top and middle quartiles for Associates and in each quartile for Vice Presidents. In addition, these data indicate that the size of this gap between women's and men's earnings is larger in the higher quartiles than in the lower quartiles.

93. At least one of the performance review metrics measures is missing for 17% percent of the sample.[75] I note here that the size of the gender pay gap is of a similar magnitude whether I

[75] Among Associates, more than 26% of observations that have non-missing values for all of the Model 2 controls (division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared (both from the most recent hire date), relevant experience prior to most recent date at Goldman, relevant experience squared, whether a direct hire into the Associate or VP position and an indicator for the fiscal year being the year of hire for those hired into Associate/VP positions directly) are missing data for at least one of these performance review metrics. Among Vice Presidents, more than 12% are missing data for at least one of these performance review metrics.

estimate the pay models on either the larger group of employees--who may or may not have performance review scores--(presented in Tables 3 and 4, discussed above) or on the subset of these employees for whom I have complete performance data (presented in Tables 15 and 16, discussed below).

94. I study the effects of the performance systems on pay using the sample with complete information on the performance review metrics, as well as the other variables included in the model. Table 15 contains estimates of the pay gap for Associates using the restricted sample with data on the average 360 score and the manager quartile. Table 16 contains results from a parallel for Vice Presidents. The Tables contain results from eight models (described in the paragraphs that follow): 2a, 2b, 2c, 2d, 3a, 3b, 3c, and 3d.

95. The top panels of Tables 15 and 16 are based on Model 2. Model 2a is defined in the same way as Model 2 in Tables 3 and 4 above. That is, it adjusts for indicators for division, year, office, education, AA job group, experience at Goldman, experience at Goldman squared (both from the most recent hire date), relevant experience prior to most recent date at Goldman, relevant experience squared, whether a direct hire into the Associate or VP position and an indicator for the fiscal year being the year of hire for those hired into Associate/VP positions directly. It differs from Model 2 only in that it is calculated using the restricted sample.

96. Models 2b-2d include measures of performance. Model 2b includes all the variables in Model 2a plus indicators for each manager quartile. Model 2c includes all the variables in Model

2a plus the 360 Degree Review score.[76] Model 2d includes all the variables in Model 2a plus indicators for both the manager performance quartile and the 360 Degree Review score.

97. The bottom panels of Tables 15 and 16 are based on Model 3, which contains all of the controls from Model 2, and adds controls for Business Unit. Model 3a differs from Model 3 only in that it is calculated using the restricted sample. Models 3b-3d include measures of performance. Model 3b includes all the variables in Model 3a plus indicators for each manager performance quartile. Model 3c includes all the variables in Model 3a plus the 360 Degree Review score. Model 3d includes all the variables in Model 3a plus indicators for each manager performance quartile and the 360 Degree Review score.

98. The estimate of Model 2a in Table 15 is the baseline specification identical to Model 2 in Table 3 for Associates, when Business Units are excluded. Model 2a is estimated using the sample with non-missing information on quartile and 360 Degree Review score, while Model 2 in Table 3 is estimated using the full sample. The estimated pay difference for Associates is virtually identical (rising from 5.3 log points (5.1 percent) when estimated on the full sample to 5.4 log points (5.2 percent) when estimated on the smaller sample that includes only people with non-missing information on quartile and 360 review score). In both cases the gender pay difference is statistically significant at the 5% level.

99. The estimate of Model 3a in Table 15 is the baseline specification identical to Model 3 in Table 3 for Associates, when Business Units are included. Model 3a is estimated using the

[76] For Models 2c, 2d, 3c, and 3d (where 3c and 3d are discussed in the following paragraph), I use two variables for 360 Review score, one for period when the score used a scale of 1 through 5 and one for the period when the score used a scale of 1 through 9.

sample with non-missing information on quartile and 360 Degree Review score, while Model 3 in Table 3 is estimated using the full sample. The estimated pay difference for Associates is virtually identical (rising from 3.6 log points (3.5 percent) in Model 3 to 3.7 log points (3.6 percent) in Model 3a, and in both cases the gender pay difference is statistically significant at the 5% level.

100. The estimates in Table 15 indicate that, among Associates, the pay difference decreases as additional performance review measures are added. The top panel reports the results of analyses based on Model 2a, which does not include Business Unit. Model 2b, which adds information on each worker's performance review quartile to the controls in Model 2a, indicates that female Associates earn 4.4 log points (4.3 percent) less than male Associates. Model 2c, which adds information on each worker's average 360 score and overall manager rating to the controls in Model 2a, indicates that female Associates earn 3.1 log points (3.1 percent) less than male Associates. Model 2d, which adds quartile, average 360 score, and overall manager rating to the controls in Model 2a, indicates that female Associates earn 3.2 log points (3.2 percent) less than male Associates. All of these differences are statistically significant at the 5% level. The final column of Table 15 presents the percent of the gender pay gap (given by Model 2a that is explained by the performance metric(s) included in each model. For Associates, including performance metrics explains between 17.8% (Model 2b) and 40.6% (Model 2c) of the pay gap given by Model 2a.[77]

[77] To compute the percentage explained by performance ratings, I subtract the percentage pay gap for a model that includes performance ratings (any of the Models 3b, 3c, or 3d) from a baseline

101. The bottom panel of Table 15 reports the results of analyses based on Model 3, which includes Business Unit. Model 3b, which adds information on each worker's performance review quartile to the controls in Model 3a, indicates that female Associates earn 2.67 log points (2.6 percent) less than male Associates. Model 3c, which adds information on each worker's average 360 score and overall manager rating to the controls in Model 3a, indicates that female Associates earn 1.3 log points (1.3 percent) less than male Associates. Model 3d, which adds quartile, average 360 score, and overall manager rating to the controls in Model 3a, indicates that female Associates earn 1.6 log points (1.6 percent) less than male Associates. In Model 3b, the difference is statistically significant. In the final two versions of this analysis (Models 3c and 3d), these differences are not statistically significant at the 5% level, which indicates that after controlling for Associates' performance, there is not a statistically significant pay gap. The final column of Table 15 presents the percent of the gender pay gap (given by Model 3a that is explained by the performance metric(s) included in each model. For Associates, including performance metrics explains between 27.5% (Model 3b and 64.6% (Model 3c) of the pay gap given by Model 3a.

102. Table 16 is based on analyses of Vice Presidents and is parallel to Table 15, and can be read analogously. The estimate of Model 2a in Table 16 is the baseline specification identical to Model 2 in Table 4 for Vice Presidents, when Business Units are excluded. Model 2a is estimated using the sample with non-missing information on quartile and 360 Degree Review

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percentage pay gap in the model without performance metrics (Model 3a) and divide the difference by the latter percentage pay gap.

score, while Model 2 in Table 4 is estimated using the full sample. The estimated pay difference between male and female Vice Presidents is virtually identical (increasing from 25.4 log points (22.4 percent) when estimated on the full sample to 26.1 log points (23 percent) when estimated on the smaller sample that includes only people with non-missing information on quartile and 360 review score. In both cases the gender pay difference is statistically significant at the 5% level.

103. The estimate of Model 3a in Table 16 is the baseline specification identical to Model 3 in Table 4 for Vice Presidents, when Business Units are included. Once again, Model 3a is estimated using the sample with non-missing information on quartile and 360 Degree Review score, while Model 3 in Table 4 is estimated using the full sample. The estimated pay difference for Vice Presidents is 24.3 log points (21.6 percent) when estimated on the full sample, and 24.8 log points (22%) when estimated on the smaller sample that includes only people with non-missing information on quartile and 360 review score.

104. Table 16 indicates that among Vice Presidents, the pay difference declines as additional performance review measures are added. The top panel reports the results of analyses based on Model 2a, which does not include Business Unit. Model 2b, which adds information on each worker's performance review quartile to the controls in Model 2a, indicates that female Vice Presidents earn 23.5 log points (20.9 percent) less than male Vice Presidents. Model 2c, which adds information on each worker's average 360 score and overall manager rating to the controls in Model 2a, indicates that female Vice Presidents earn 22.6 log points (20.2 percent) less than male Vice Presidents. Model 2d, which adds quartile, average 360 score, and overall manager rating to the controls in Model 2a, indicates that female Vice Presidents earn 22.2 log points (19.9 percent) less than male Vice Presidents. All of these differences are statistically

significant at the 5% level. The final column of Table 16 presents the percent of the gender pay gap (given by Model 2a that is explained by the performance metric(s) included in each model. For Vice Presidents, including performance metrics explains between 8.9% (Model 2b) and 13.5% (Model 2d) of the pay gap given by Model 2a.[78]

105. The bottom panel of Table 16 reports the results of analyses based on Model 3, which includes Business Unit. Model 3b, which adds information on each worker's performance review quartile to the controls in Model 3a, indicates that female Vice Presidents earn 21.9 log points (19.7 percent) less than male Vice Presidents. Model 3c, which adds information on each worker's average 360 score and overall manager rating to the controls in Model 3a, indicates that female Vice Presidents earn 21 log points (18.9 percent) less than male Vice Presidents. Model 3d, which adds quartile, average 360 score, and overall manager rating to the controls in Model 3a, indicates that female Vice Presidents earn 20.6 log points (18.6 percent) less than male Vice Presidents. Each of these differences is statistically significant at the 5% level. The final column of Table 16 presents the percent of the gender pay gap (given by Model 3a that is explained by the performance metric(s) included in each model. For Vice Presidents, including performance metrics explains between10.7% (Model 3b) and 15.4% (Model 3d) of the pay gap given by Model 3a.

[78] To compute the percentage explained by performance ratings, I subtract the percentage pay gap for a model that includes performance ratings (any of the Models 3b, 3c, or 3d) from a baseline percentage pay gap in the model without performance metrics (Model 3a) and divide the difference by the latter percentage pay gap.

106. The general pattern is that, among Vice Presidents, the gender pay gaps are negative and remain statistically significant when the performance measures are accounted for in the model. Among Associates, if Business Units are not included in the model, the gender pay gap remains statistically significant. Among Associates, if Business Units are included, the gender pay gaps are negative but become statistically insignificant when the performance measures and Business Units are accounted for in the model (except for Model 3b, where the pay gap remains statistically significant). Among both Associates and Vice Presidents, the gender pay gaps are smaller (less negative) when the performance measures are accounted for in the model.

107. In summary, my analysis indicates that, as between men and women who are the same in terms of the factors included in my model, women are less likely to be placed in the top quartile and receive lower ratings on the 360 Degree Review. Among Associates, these differences between women's and men's quartile and 360-degree review ratings explain about 2 percentage points (under both Models 2 and 3) or (38.9 or 55.8 percent, under Models 2 and 3, respectively) of the overall average pay difference. Among Vice Presidents, differences between women's and men's quartile and 360-degree review ratings explain 3.1 or 3.3 percentage points (approximately 13.5 or 15.1 percent, under Models 2 and 3, respectively) of the overall average pay difference. On the basis of these findings, I conclude that placement into Quartile ranks and 360 Degree Review scores are factors that contribute to differences in pay between men and women, for both Associates and Vice Presidents.

D. Persistence of Gender Pay Gap Since 2016

108. Goldman made changes to the scale of its 360 review system in 2016. I have been asked to analyze whether these changes impacted the gender pay disparity at Goldman.

While there is less evidence of discrimination in ratings under the qualitative 360 review system, I find that the pay gap among VPs has not shrunk since 2016.

1. Changes to Performance Review Metrics

109. In 2016, Goldman implemented changes to the scale of its performance rating system. Through 2015, Goldman computed an average 360-score and a quartile for each employee. Starting in 2016, the quartile remains, but the numerical 360-score was retired, while a categorical Overall Manager Rating was instated.

110. Table 17 describes the Overall Manager Rating in the period 2016-2018. The rating can take on one of three values: "Outstanding," "Good," or "Needs Improvement." In practice, the last of these is rarely used, so more than 95% of Associate observations for each gender and 98% of Vice President observations for each gender possess a score of "Outstanding" or "Good." The Overall Manager Rating is, then, a coarser metric than the 360-score used through 2015.

111. Table 17 shows that, among Associates, women are more likely to obtain the highest rating of "Outstanding" and less likely to receive the lowest rating of "Needs Improvement." Among Vice Presidents, women and men are equally represented in the lowest rating of "Needs Improvement", while men are somewhat more likely to obtain the highest rating of "Outstanding."

112. Table 18 presents the number and percentage of men and women in each quartile for the same time period (2016-2018). Among both Associates and Vice Presidents, women are more likely than men to be in the top quartile.

113. To understand whether any of the gender-based difference in these two performance ratings are statistically meaningful during the 2016-2018 period, I perform a probit analysis on (1) the probability of receiving an Overall Manager Rating of "Outstanding," and (2) the probability of being rated in the top quartile during the 2016-2018 period. Table 19 presents the results of this analysis for Associates, and Table 20 presents results for Vice Presidents.

114. In Table 19, I show that there are no statistically significant differences between male and female Associates in either the probability of being rated as "Outstanding" or the probability of being placed in the top quartile during the 2016-2018 period. All Z-scores in Column 4 of Table 19 are less than 1.96. In Table 20, I show that there are no statistically significant differences between male and female Vice Presidents in either the probability of being rated as "Outstanding" or the probability of being placed in the top quartile during the 2016-2018 period. All Z-scores in Column 4 of Table 20 are less than 1.96. I conclude that there is no statistically significant difference between women and men in ratings after 2016. This diminishing of the performance rating gap between men and women has not resulted in a corresponding reduction of the gender pay gap across Vice Presidents.

2. Impact of Changes in Performance Review System on Gender Pay Disparity

115. I have been asked to determine whether the changes to a qualitative performance review scale, as described above, have impacted the gender pay disparity at Goldman. To answer this, I analyze how the pay gap changed after 2015 for several groups of employee-years.

116. Table 21 presents summary statistics for average pay of men and women in the years prior to 2016 (i.e., 2003-2015) and the three years for which I have data on the qualitative rating system (2016-2018), as well as for the entire time period (2003-2018). I present this model as a reference point for the other models and draw no conclusions from these data. The top panel presents these data for Associates, while the bottom panel presents these data for Vice Presidents. I find that the gender difference in average pay among Associates falls from 14.7% over the years 2003-2015 to 2.9% over the years 2016-2018. Among Vice Presidents, the gender difference in average pay increases from 28.6% over the years 2003-2015 to 30.3% over the years 2016-2018.

117. Table 22 presents the results of regression analyses over the same time periods (2003-2015 and 2016-2018), where the later period is the time frame during which 360 performance reviews were qualitative. Each row presents the results of a regression analysis for a different model. In all cases, I have estimated a single model over the entire time frame (2003-2018), but I have included two female indicators. The first female indicator takes a value of one when an observation concerns a female employee in the earlier period (2003-2015), while the second female indicator takes a value of one when an observation concerns a female employee in the later period (2016-2018). Additionally, I include a period indicator that takes a value of one for all observations in the 2016-2018 period. This modified model allows me to examine the gender pay gap separately over these two time periods (2003-2015 versus 2016-2018). Model 1 (presented in Row 1) has no controls beyond the female and period indicators. Model 2 (presented

in Row 2 adds my basic set of controls.[79] Model 3 (presented in Row 3 adds controls for the basic set of Model 2 controls, and additionally Business Unit controls. The top panel presents the results of this analysis for Associates. The bottom panel presents the results of this analysis for Vice Presidents. Within each panel, Columns 1-3 report respectively: the gender pay gap (expressed in logs), t-ratio of the gender coefficient, and the gender pay gap expressed as a percent over the years 2003-2015. Columns 4-6 report these statistics over the time period 2016-2018.

118. For Associates in Model 1, the gender pay gap decreases from 8 log points over the period 2003-2015 to 0.5 log points over the period 2016-2018. The former of these is statistically significant, but the latter is not. For Associates in Model 2, the gender pay gap decreases from 6.6 log points over the period 2003-2015 to 0.6 log points over the period 2016-2018. The former of these is statistically significant, but the latter is not. For Associates in Model 3, the gender pay gap changes sign from 4.8 log points over the period 2003-2015 to positive 0.2 log points over the period 2016-2018.[80] The former of these is statistically significant, but the latter is not.

119. For Vice Presidents in Model 1, the gender pay gap increases from 27.7 log points over the period 2003-2015 to 33 log points over the period 2016-2018. Both of these coefficients are statistically significant. For Vice Presidents in Model 2, the gender pay gap increases from 25.2 log points over the period 2003-2015 to 28.8 log points over the period 2016-

[79] Tenure at Goldman (and its square), related experience (and its square), Business Unit, quartile, 360 score (through 2015) and overall manager rating (from 2016), AA Job Group, city, education, lateral-hire status, and year.

[80] This is, that this model estimates slightly higher pay for women than for men among Associates in 2016-2018, after controlling for Model 3 controls.

2018. Both of these coefficients are statistically significant. For Vice Presidents in Model 3, the gender pay gap increases from 23.3 log points over the period 2003-2015 to 29 log points over the period 2016-2018. Both of these coefficients are statistically significant.

120. The general pattern of these tables indicates that for Associates, the pay gap decreased between the period 2003-2015 and is no longer statistically significant during the 2016-2018 period. For Vice Presidents, however, the pay gap remains significant, and is estimated to be larger during the 2016-2018 period relative to earlier years.

121. An important difference between Associates and Vice Presidents that could account in part for the contrast found in Table 22 with regard to the change over time to the female-male pay gap, is their relative tenure with Goldman. As I describe in the next paragraph, Associates in the 2016-2018 period are unlikely to have had much exposure to pre-2016 performance evaluations so that their current compensation is less likely to be adversely affected by these earlier evaluations. In contrast, Vice Presidents in the 2016-2018 period have been with Goldman long enough to have substantial exposure to pre-2016 performance evaluations and are more likely to adversely affected by these earlier evaluations.

122. Table 23 lists, separately for Associates and Vice Presidents, the percent of observations from the 2016-2018 period which are associated with a person with 0, 1, 2, 3, 4, or 5 or more performance reviews from the 2003-2015 time period, as well as the average number of performance reviews from the 2003-2015 time period. This analysis shows that 75% of Associates in 2016-2018 have zero pre-2016 performance reviews, while for Vice Presidents this number is 33%. On the other end of the spectrum, almost no Associates in 2016-2018 have five or more performance reviews prior to 2016, while approximately 27% of Vice Presidents do.

Among Associates working at Goldman during the period 2016-2018, the average number of performance reviews over the 2003-2015 period was 0.4, while for Vice Presidents, this number was 2.3. Over the 2016-2018 time period, Vice Presidents are more likely than Associates to have performance reviews from prior to 2016, and these Vice Presidents also have a longer history of performance reviews than do Associates.

123. As described in paragraph 26 above, if performance ratings explain part of the pay gap prior to 2016, one cannot expect an existing pay gap to disappear even if gender disparities in the rating system are removed. This is because Goldman continues to base future pay on past pay values.[81] In order for the pay gap among Vice Presidents (who are often legacy workers with substantial exposure to the performance evaluation system prior to 2016) to close, Goldman would have to recognize – and then correct for – the degree to which their current pay values reflect past discrimination in the present time frame.

124. In order to fully correct the use of gender-biased performance evaluations in setting compensation in prior years, Goldman would have needed to increase the total compensation of women after 2016 in the form of a pay equity adjustment. There is no statistical evidence that Goldman in fact made that type of pay equity adjustment for Vice Presidents from 2016 to the present. I calculate the total value of raises that it would take to bring women to pay parity in paragraph 146.

[81] See fn 16, above

VII. Analysis of Promotions

125. In this section of my report, I describe the results of my analysis of differences in promotion rates from Vice President to Managing Director between men and women in class positions at one of Goldman's US offices from 2003 through 2018.[82]

126. Because the promotion to VP is a discrete event with two possible outcomes (promotion or not), I use a multivariate statistical model appropriate to discrete outcomes known as a probit model.[83] I estimate a probit model of the likelihood of promotions as a function of year, number of years as Vice President, division, office, education, experience at Goldman, experience at Goldman squared (both from the most recent hire date), relevant experience prior to most recent date at Goldman (including experience in prior periods of employment at Goldman), relevant experience squared, AA job group, and whether a direct hire into the VP position. I combine education levels "Bachelor's Degree," "Associates Degree," and "Some College" together into a single "BA or lower" category.[84]

127. In calculating this model, I first assemble a snapshot of Vice Presidents in the three relevant revenue-producing divisions at the end of each fiscal year from 2003 through

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[82] In analyzing promotions, I consider only promotions from positions in Goldman's Securities Division, IBD, and IMD to positions in Securities, IBD, and IMD in the United States.

[83] This is the same statistical model I used to study placement in the top quartile. Again, the probit model is analogous to the multiple regression model I used to analyze pay differences.

[84] I do not include Business Units in my promotions analysis for several reasons. First, Business Units are not available in all divisions in 2003, though we do observe promotions in 2004 (which are based on decisions made in 2003). Second, the Declarations provided by Goldman to identify Business Units describe these as being relevant to the compensation setting process, but not to the promotions process (Kozlowski Declaration at ¶¶ 4-5, Cassidy Declaration at ¶¶ 5-8, and Cupertino Declaration at ¶¶ 6-7, each of which describes "the organization level at which Business Unit compensation budgets were allocated" for various time periods and divisions.

2017. I then determine which of these Vice Presidents was promoted to a position as Managing Director in one of the three relevant revenue-producing divisions during the following fiscal year.[85] I thus analyze promotions during the period 2003 through 2018. Note that in 2015 Goldman transitioned from an annual promotion process from Vice President to Managing Director to one that takes place in alternate years.

128. The approach I use is to estimate a benchmark promotion model for males only and use the resulting coefficient estimates to predict promotion probabilities for females using the observed characteristics (education, experience, direct hire, job group, division, year, and time as VP) of the females. The sum of these probabilities is the number of women one would have expected to be promoted if a woman with a given set of characteristics had the same probability of promotion as a man with the same characteristics. I use a standard statistical technique known as "bootstrapping" in order to test for the statistical significance of my results.[86] I estimate the promotion model described above by resampling the data on the male Vice Presidents at random, with replacement.[87] I calculate for each sample a number of expected promotions for female Vice Presidents. I repeat this procedure 1,000 times.[88]

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[85] I also require promotions to be into the United States. Prior to 2008, I observe a small number of promotions outside of the US, but beginning in 2009 the data I have received from Goldman do not include promotions to locations outside of the US. In order to be consistent, I do not include promotions outside of the US as promotions for the purposes of this analysis.

[86] For a discussion of bootstrapping, see box "A Brief Introduction to Bootstrapping," Wooldridge pp. 223-224.

[87] See Wooldridge p. 223.

[88] This number is a "typical" number of replications. Wooldridge p. 224.

129. Doing so allows me to calculate a 95 percent confidence interval for the distribution of the number of promotions for female Vice Presidents (corresponding to a five percent significance level).[89] If the 95 percent confidence interval includes the actual observed number of promotions for women, this is evidence that there is a greater than five percent probability that the difference I have calculated arose from random chance rather than as a result of a true difference in promotions between men and women. This would indicate that my result is not statistically significant at the five percent level. However, if the 95 percent confidence interval does not include the actual observed number of promotions for women, this is evidence that there is less than five percent probability that the difference I have calculated arose from random chance rather than as a result of a true difference in promotions between men and women. This would indicate that the difference is statistically significant at the five percent level, and I would conclude that the difference I have found is not simply the result of random chance.

130. The procedure outlined in paragraphs 128 and 129 allows me to predict the number of promotions among women one would expect in the absence of discrimination. The expected number of women's promotions can then be compared to the actual number of promotions among women.

131. I display the results of this analysis in Table 24. I display the total number of observations on men in Column 1. This is the number of male person/years contained in annual "snapshot" data. I report the promotion rate for men in Column 2. It indicates that the percentage

[89] The 95 percent confidence interval is the range from the 0.025 percentile to the 0.975 percentile of the distribution of the 1,000 bootstrap estimates of the racial difference in failure rates.

of male person/years where the individual in question was promoted during the following fiscal year. This number is 3.87 percent. In Column 3 I report the total number of observations on women. This is the number of female person/years contained in my annual "snapshot" data. Column 4 reports the promotion rate among women. It is 3.08 percent.

132. I report the actual number of promotions from VP to EMD among women (204) in Column 5. Column 6 reports the expected number of promotions among women, if women were treated the same as men with regard to promotion. The expected number of promotions for women 229.

133. Column 7 presents the difference between the actual and the expected number of promotions for women. It indicates that women experienced 25 fewer promotions than they would have if they had been promoted according to the model of promotions that applies among comparable men.

134. Columns 8 and 9 present the lower and the upper bounds, respectively, of the 95 percent confidence interval for the number of promotions for women. The observed value of promotions for women in Column 5 (204) is below the lower bound of the 95 percent confidence interval in Column 8 (215). This means that the number of observed promotions for women is different from the expected number of promotions, and that the difference is statistically significant at the 5% level.

135. I conclude that these data provide statistically significant evidence of a lower promotion rate among women than among otherwise similar men.

VIII. Estimate of Damages

136. In this section of my report, I calculate estimated damages associated with the gender gap in pay and promotion rates.

137. Table 25 presents estimates of damages resulting from gender disparity in pay, based on Models 2a and 2d (presented in Tables 15 and 16). Column 1 of Table 25 reports the total earnings of class members during the class period.[90] In order to calculate total earnings for class members, I have totaled per-annum total compensation (PATC) for class members during the class period, pro-rated for the portion of the year during which each class member worked at an in-class position at Goldman.[91] I also pro-rate each class member's salary for the portion of the year that she was on unpaid leave as well as make adjustments for the portion of the year she worked part-time. I calculate separate compensation pools for Associates and Vice Presidents.

138. The class consists of female financial-services employees who are or have been employed by Goldman as Associates or Vice Presidents in revenue-producing positions in the IMD, IBD, or Securities divisions at any of its offices in the United States as of September 10,

[90] In addition to the 3,116 women in the analysis file used in this report, I have also included an additional 264 women from the Class List File provided by Goldman Sachs on September 6, 2018.

[91] For class members who spent part of the year as an Associate and part of the year as a Vice President, I allocate PATC between these two categories based on the amount of time served in each role. For instance, if a class member earned a PATC of $600,000 in a single year, and worked as an Associate for three months and a Vice President for nine months, I would allocate $150,000 of her PATC to the Associate pool for that year, and the remaining $450,000 to the Vice President pool.

2004 and/or at Goldman's New York office as of July 7, 2002.[92] However, I have been instructed by counsel that the appropriate period to calculate back pay damages for the non-New York class is July 6, 2003. Because my analysis reported in the top panel of Table 22 shows no statistically significant pay gap among Associates beginning in 2016, I end my damages calculation for Associates on December 31, 2015. Because this analysis shows a continuation of pay differences into this period for Vice Presidents, I calculate damages for Vice Presidents through June 31, 2021.

139. As a result of these calculations, I estimate that Associate members of the class at Goldman earned $832 million and Vice President members of the class at Goldman earned $4.22 billion during the class period. These numbers are reported in Column 1 of Table 25. For the purposes of these damages calculations, I assume that the number of Vice President class members and their compensation remains at the 2018 level in 2019, 2020, and through June of 2021. This projection is limited to the women included in my analyses.[93] As described in ¶ 138 above, I calculate damages for Associates only through December 31, 2015.

140. I have estimated the gender disparity in pay for Associates and Vice Presidents separately and reported my findings in Tables 15 and 16. Model 2a in Table 15 presents a gender pay difference for Associates. This difference is equal (in absolute value) to 5.2%.

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[92] Second Amended Class Action Complaint, H. Christina Chen-Oster, Shanna Orlich, Allison Gamba, and Mary De Luis v. Goldman Sachs & Co. and The Goldman Sachs Group, Inc., August 3, 2015 (the "complaint"), ¶¶ 60-62.

[93] I do not make the same projection for the women who leave the class before the end of the fiscal year, or those with missing compensation.

Model 2a in Table 16 presents a gender pay difference for Vice Presidents. This difference is equal (in absolute value) to 23%. These figures are reported in Column 2 of Table 25.

141. I define a "pay-gap factor" as the proportion by which women's pay would have to be increased to equalize men's and women's pay on average. For example, if a woman and a man with similar characteristics earn $80 and $100 respectively for doing the same work, the difference in pay between the two is $20, or 20% of male pay. The proportional pay gap (call it γ) is 0.2. However, if a woman's pay were increased by 20%, she would earn only $96 and not $100. Her pay needs to be increased by a pay-gap factor of $\frac{\gamma}{(1-\gamma)}$ = (0.2/(1-0.2)) (or 25% in this example) in order to make her pay equal to that of the man. In order to calculate damages, I use the pay-gap factor of $\frac{\gamma}{(1-\gamma)}$ where γ is the estimated proportional difference in pay. [94]

142. These pay-gap factors are reported in Column 3 of Table 25. A pay gap of 5.2% for Associates corresponds to a pay-gap factor of 5.51%. A pay gap of 23% for Vice Presidents corresponds to a pay-gap factor of 29.8%.

143. The total earnings in Column 1 of Table 25 are multiplied by these pay-gap factors (presented in Column 3). The results of this are presented in Column 4 of Table25. It yields an overall damages estimate of $45.8 million for Associates and an overall damages estimate of $1.24 billion for Vice Presidents.

144. The remainder of Table 25 reports estimated damages for the portion of the pay gap associated with performance reviews. These estimates are based on the portion of the

[94] γ represents the value of the percent difference in pay (dividing by 100 to yield the proportional difference in pay) in Models 2a and 3a of Tables 15 and 16.

Model 2a pay gap explained by the performance review measures from Model 2d reported in Column 6 of Tables 15 and 16.[95]

145. The portion of damages attributed to the performance review may be understood as follows. The example in paragraph 141 assumed a gender pay gap of 20. Suppose that after controlling additionally for the performance review, the pay gap between a male and a female employee is 15%, and the goal is to close only the portion of the pay gap that is associated with performance review. In other words, the goal is to move women's pay from 80% to 85% of men's pay. In order to accomplish this, women's pay would need to be increased by a factor of $\left(\frac{1-0.15}{1-0.2} - 1\right) = 0.0625$. More generally, the additional amount of money required to close the portion of the pay gap that is associated with performance reviews is calculated by multiplying her pay by what I will term the "pay gap factor for performance" $\left(\frac{(1-\gamma_d)}{(1-\gamma_a)} - 1\right)$, where γ_a is the percentage gender pay gap in the model that does not control for performance (e.g. Model 2a), and γ_d is the percentage gender pay gap in the model that does control for performance (e.g. Model 2d).

146. Column 5 of Table 25 reports the percent pay gap that remains after controlling for the variables in Model 2d (see Tables 15 and 16). I calculate the pay-gap factor for performance as described in paragraph 145, above, and report this in Column 6 of Table 25. This pay-gap factor for performance is 2.14% for Associates and 4.04% for Vice Presidents.

[95] Model 2d, in addition to the standard controls, also include: quartile, average 360 review score, and overall manager rating.

147. In order to determine the value of damages associated with the performance metric, I multiply the total in-class compensation (reported in Column 1 of Table 25) times the pay-gap factor for performance metrics, reported in Column 6 of Table 25. This product is reported in Column 7 of Table 25. I estimate that, among Associates, performance reviews are associated with $17.8 million of damages. I estimate that, among Vice Presidents, performance reviews are associated with $170.2 million of damages.

148. I have been asked by counsel for the Plaintiffs to adjust these damages totals to account for the fact that certain women may have been excluded from the class. Table 26 accounts for these exclusions. The top panel of Table 26 repeats Table 25 and is included for ease of comparison. The middle panel of Table 26 excludes those former Class members who either: 1) opted out of the class in a timely manner; 2) signed severance agreements before the original complaint was filed; or 3) signed Managing Director agreements with arbitration agreements therein before the original complaint was filed. I refer to this group as "Exclusion Group 1." After excluding those individuals in Exclusion Group 1, I estimate $38.2 million in damages for Associates, of which $14.9 million are associated with performance reviews, and $1.05 billion in damages for Vice Presidents, of which $141.5 million are associated with performance reviews. The bottom panel of Table 26 excludes those former Class Members who were excluded in middle panel, as well as individuals who the Magistrate Judge has ruled should be excluded from the class because they signed a valid arbitration agreement and/or severance agreement. I understand that this issue is pending review before the District Court. Thus, the bottom panel of Table 26 is similar to the middle panel, but also excludes class members who: 1) signed a severance

agreement; 2) signed a Managing Director agreement with an arbitration agreement therein; or 3) signed a Private Wealth Management agreement with an arbitration agreement therein. It does not exclude class members who accepted Equity Awards.[96] I refer to this group as "Exclusion Group 2." After excluding those individuals in Exclusion Group 2, I estimate $31.3 million in damages for Associates, of which $12.1 million are associated with performance reviews, and $734.6 million in damages for Vice Presidents, of which $99.3 million are associated with performance reviews.

149. The damages reported in Table 25 are associated with harm to class members that has already occurred ("backpay").[97] Table 27 follows a similar format as Table 25, above, but presents the total value of pay increases required to bring female Vice Presidents to pay parity with men, going forward. This is simply a one-year estimate of "current" total pay (reported in Column 1), again multiplied by the pay-gap factor (described in ¶ 141, above, and reported in Column 3). This yields a total value of raises necessary to bring female Vice Presidents to pay parity of $67.8 million. Considering only the portion of the gender pay gap that is due to differences in performance reviews, the total value of raises necessary to bring female Vice Presidents to pay parity is $9.2 million.

150. Table 28 presents estimates of damages resulting from gender disparity in promotions. These estimates are based on the promotions shortfall for women that I calculate by

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[96] The exclusions described in this paragraph are based on the file "Goldman_s List of Arbitration Agreements 2020-1-30.xlsx".

[97] Damages are currently estimated through June 2021, approximately six months after the date of this report.

finding the difference between the observed and the expected promotions for women, and on the differences in total earnings of the Vice Presidents and the Extended Managing Directors.

151. I previously calculated the total shortfall in promotions for female Vice Presidents to be 25 over the period of 2003-2018.[98] Because promotions in certain years might be worth more than promotions in other years, I have estimated the size of the promotion shortfall separately by year. In order to do so, I use the promotion model described in Section VII above to predict the probability of promotion for women in each year, if they had been promoted at the same rate as men with the same observed characteristics, separately for each year 2002-2018.[99] I have been instructed by counsel to assume that the promotion shortfall in 2002 is equal to the promotion shortfall in 2003.[100] I then sum the probabilities of promotion for women for each year in which promotions took place and arrive at an expected number of promotions for women in that year. I then compare this number to the number of actual promotions women had in that year. Table 28 presents the results of this analysis.

152. Column 1 of Table 28 reports the number of promotions from VP to EMD for class members in each year. Column 2 reports the expected number of promotions for women, predicted as described in ¶ 151, above. Column 3 reports the difference between the expected number of promotions and the observed number of promotions for women in each year. In most

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[98] *See* Table 24 and ¶ 138, above.

[99] Years in which no promotions occurred have zero predicted promotions.

[100] I understand that this instruction is based on a letter from Barbara Brown (Counsel for Goldman) to Anne Shaver (Counsel for the Plaintiffs) dated September 27, 2012, which acknowledges that the PeopleSoft data prior to 2004 is incomplete (namely, it does not include people who left the covered population between January 2002 and September 2004).

years, the difference is positive, indicating that fewer women were promoted compared to what I would expect. In a few years (namely, 2010, 2012, and 2015) the difference between the expected and the observed promotions is negative. This indicates that more women were promoted in that year relative to what I would expect. To the extent that some of the differences are negative, I "credit" Goldman for these negative shortfalls in a subsequent step of my damages calculation, effectively reducing my estimate of damages from disparities in promotion. I calculate two "total" rows, one that includes 2002 (which I have assumed on the instruction of counsel to be identical to 2003), and one that does not. Not that the "total" row that does not include 2002 has the same overall shortfall as was estimated over the entire time period, presented in Table 24.

153. In order to determine the damages associated with a foregone promotion, I need a measure of the difference in compensation between EMDs and Vice Presidents. Goldman provided the average total earnings (PATC) of its EMDs by year (2003-2017) and groups of tenure as an EMD (one year or less, 2-5 years, more than 5 years).[101] I use these data and 90th percentile of total earnings of female Vice Presidents at Goldman in a given year to calculate the difference in total earnings between a Vice President and an EMD for each year.[102]

154. The damages calculation proceeds as follows. If a female Vice President at Goldman does not receive a promotion to EMD in year *t*, her damages estimate for year *t+1* is equal to the difference between average earnings of an EMD (with one or fewer years of tenure as EMD) in year *t+1* and the 90th percentile of earnings of female Vice Presidents at Goldman at *t*. In

[101] GS CCO - Summary of EMD PATC – 20180913.xlsx

[102] I use the 90th percentile of female Vice President earnings because promotions tend to occur among high earners within a job title.

year *t+2*, after having been denied promotion in year *t,* the Vice President will have missed out on two years of EMD pay which is the sum of the differences between total EMD pay and VP pay in years *t+1* and *t+2*. The following year she will have missed out on three years of EMD pay, and so on, through the last year of my damages calculations.[103] However, there is a probability that at any point she may leave Goldman and seek employment elsewhere. I assume the probability of an EMD leaving Goldman in any year to be 0.11, which is the average rate of EMD terminations over the time period 2003-2016.[104] To adjust for the possibility of attrition, I adjust the damages estimate by the attrition rate (0.11) for each year starting from year *t+1* through the last year of my damages calculation.[105]

155. Table 29 contains results of these calculations. Column 1 presents the estimated value of a promotion for years 2002-June 2021.[106] For instance, the value of a missed promotion in 2003 is equal to $9,831,150. This summarizes the differences in EMD and VP pay (adjusted for tenure as EMD and the probability of attrition each year) through June 2021. This number is multiplied by the promotions shortfall in 2003 reported in Column 2 to arrive at the damages associated with the promotions shortfall in that year (reported in Column 3). As with the

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[103] In years *t+2* through *t+5*, I use average pay on EMDs with 2-5 years of tenure as an EMD, and for years t+6 and greater, I use average pay on EMDs with more than 5 years of tenure as an EMD. I note that because this analysis does not include the possibility of further promotions beyond EMD (e.g. to Partner, with commensurately higher salary), this analysis understates damages associated with wrongfully denied promotions.

[104] GS CCO Summary of EMD Prom Term - 20180913.xlsx

[105] In particular, I multiply the annual damages estimate associated with year *t+2* times (0.89); I estimate the annual damages estimate associated with year *t+3* times (0.89^2), etc.

[106] These are promotion shortfalls through 2018, the last year for which I have data. However, the value of a promotion shortfall in each year has been valued through June 2021.

previous table, I have been instructed by counsel to assume that the value of a promotion in 2002 is the same as it was in 2003.

156. I proceed to estimate damages for gender disparity in promotion in this way through June 2021 making adjustments for the attrition rate and the differences between EMD and VP pay by year and tenure as EMD. For years in which the adjusted shortfall is negative (indicating that more women were promoted than I expected), I calculate negative damages, which offset a portion of the damages total. Summing across all years 2003-2018, I find that there was a shortfall of 25 promotions, and I estimate total damages associated with this promotion shortfall to be equal to $160.5 million. Summing across all years 2002-2018, I find that there was a shortfall of 26 promotions, and I estimate total damages associated with this promotion shortfall to be equal to $170.9 million.

157. I also perform a similar exercise as described in ¶ 148, above to exclude from this damages calculation certain Class members who have been excluded or may be excluded from the Class. Unlike with the compensation analysis described above, however, I cannot directly identify which particular individuals were denied the one of the promotion opportunities that I calculate as a shortfall. Because of this, I have calculated, separately for each year, the share of person-years represented by women in each of the Exclusion Groups.[107] I then reduce the damages estimate associated with lost promotions in each year by the proportion of female Vice

[107] That is, I calculate, among women who were employed as Vice Presidents at the end of each year (and so were in the pool of people who might have been promoted for the following year), the following three groups: Exclusion Group 1; Exclusion Group 2; all remaining class members.

Presidents who may be excluded from the class for the reasons discussed in ¶148, above. The results of this analysis are presented in Table 30.

158. I reserve the right to supplement my opinion should additional information become available to me.

Henry S. Farber
January 15, 2021

Table 1
Employee Years in Analysis Sample, by Title and Gender

Associates

	Number of Person-Years	Percent	Number of Individuals	Percent
Women	4,596	27.9%	2,078	28.1%
Men	11,887	72.1%	5,309	71.9%
Total	16,483	100.0%	7,387	100.0%

Vice Presidents

	Number of Person-Years	Percent	Number of Individuals	Percent
Women	6,626	22.3%	1,815	24.2%
Men	23,141	77.7%	5,699	75.8%
Total	29,767	100.0%	7,514	100.0%

The sample for this table includes all Associates and Vice Presidents, in the New York class from 2003 to 2018, and nationally from 2005 to 2018.

Table 2
Mean Annual Earnings, by Title and Gender

Associates

	Mean, Men	Standard Deviation, Men	Mean, Women	Standard Deviation, Women
Annual Earnings	$277,899	$311,495	$244,135	$189,401
Log of Annual Earnings	12.34	0.56	12.27	0.49

Vice Presidents

	Mean, Men	Standard Deviation, Men	Mean, Women	Standard Deviation, Women
Annual Earnings	$707,841	$764,091	$495,802	$454,097
Log of Annual Earnings	13.16	0.74	12.87	0.67

The sample for this table includes all Associates and Vice Presidents, in the New York class from 2003 to 2018, and nationally from 2005 to 2018. The data include 4596 employee-year observations on female Associates, 11887 observations on male Associates, 6626 observations on female Vice Presidents, and 23141 observations on male Vice Presidents. Earnings for part-year workers are adjusted to a full-year equivalent level.

Table 3
Regression Analysis of the Male/Female Pay Difference, Associates

	Log-Point Difference	T-Ratio	Percent Difference	Employee-Years in Sample	Adjusted R-squared
Model	[1]	[2]	[3]	[4]	[5]
Model 1	-0.068	5.12	-6.6%	16,247	0.003
Model 2	-0.053	5.10	-5.1%	16,247	0.312
Model 3	-0.036	3.91	-3.5%	15,414	0.464

The table gives an absolute value of the t-ratio for the test of no difference in earnings between men and women. Generally speaking, a t-ratio with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. T-ratios were calculated using robust standard errors clustered by individual employee. Negative differences indicate that women receive earnings that are lower, on average, than those of men who have the same levels of characterics included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variable in Model 2 are non-missing.

Model 1 is the difference between the average earnings of men and women. It is included for reference.

Model 2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model 3 includes all the same variables as Model 2 and, in addition, Business Unit. It is limited to the years 2004 through 2018, the period of time over which I have information on Business Units in each division.

Table 4
Regression Analysis of the Male/Female Pay Difference, Vice Presidents

	Log-Point Difference	T-Ratio	Percent Difference	Employee-Years in Sample	Adjusted R-squared
Model	[1]	[2]	[3]	[4]	[5]
Model 1	-0.296	14.21	-25.6%	29,684	0.028
Model 2	-0.254	13.48	-22.4%	29,684	0.210
Model 3	-0.243	13.43	-21.6%	28,594	0.360

The table gives an absolute value of the t-ratio for the test of no difference in earnings between men and women. Generally speaking, a t-ratio with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. T-ratios were calculated using robust standard errors clustered by individual employee. Negative differences indicate that women receive earnings that are lower, on average, than those of men who have the same levels of characterics included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variable in Model 2 are non-missing.

Model 1 is the difference between the average earnings of men and women. It is included for reference.

Model 2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model 3 includes all the same variables as Model 2 and, in addition, Business Unit. It is limited to the years 2004 through 2018, the period of time over which I have information on Business Units in each division.

Table 5
Number of Person-Years by Quartile, Associates

Quartile	Male	Percent, Male	Female	Percent, Female
1	2,424	28.2%	869	25.8%
2/3	4,270	49.6%	1,764	52.4%
4/5	1,914	22.2%	735	21.8%

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

A chi-squared test for the independence of gender and quartile placement yields a test statistic of 8.769 with an associated p-value of .012

Table 6
Number of Person-Years by Quartile, Vice Presidents

Quartile	Male	Percent, Male	Female	Percent, Female
1	5,521	27.4%	1,500	25.6%
2/3	10,019	49.7%	2,917	49.7%
4/5	4,626	22.9%	1,453	24.8%

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

A chi-squared test for the independence of gender and quartile placement yields a test statistic of 12.013 with an associated p-value of .002

Table 7
Probit Regression Analysis of the Male/Female Placement in the Top Quartile, Associates

	Regression Coefficient	T-Ratio	Marginal Effect	Z-Score	Employee-Years in Sample
Model	[1]	[2]	[3]	[4]	[5]
Model P1	-0.071	2.046	-0.024	2.048	11,976
Model P2	-0.097	2.719	-0.031	2.724	11,976
Model P3	-0.106	2.913	-0.034	2.918	11,743

The table gives an absolute value of the Z-score for the test of no difference in the top quartile placement between men and women in a probit regression. A Z-score with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. Z-scores were calculated using standard errors clustered by individual. The marginal effect is the discrete difference between females and males in the probability of being in the top quartile implied by the regression coefficients in column [1]. A negative marginal effect implies that females are less likely to be in the top quartile than males accounting for the factors included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

Model P1 is the difference between the average earnings of men and women. It is included for reference.

Model P2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model P3 includes all the same variables as Model 2 and, in addition, Business Unit. It is limited to the years 2004 through 2018, the period of time over which I have information on Business Units in each division.

Table 8
Probit Regression Analysis of the Male/Female Placement in the Top Quartile, Vice Presidents

	Regression Coefficient	T-Ratio	Marginal Effect	Z-Score	Employee-Years in Sample
Model	[1]	[2]	[3]	[4]	[5]
Model P1	-0.056	1.606	-0.018	1.607	26,036
Model P2	-0.103	2.932	-0.032	2.937	26,036
Model P3	-0.115	3.184	-0.036	3.190	25,589

The table gives an absolute value of the Z-score for the test of no difference in the top quartile placement between men and women in a probit regression. A Z-score with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. Z-scores were calculated using standard errors clustered by individual. The marginal effect is the discrete difference between females and males in the probability of being in the top quartile implied by the regression coefficients in column [1]. A negative marginal effect implies that females are less likely to be in the top quartile than males accounting for the factors included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

Model P1 is the difference between the average earnings of men and women. It is included for reference.

Model P2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model P3 includes all the same variables as Model 2 and, in addition, Business Unit. It is limited to the years 2004 through 2018, the period of time over which I have information on Business Units in each division.

Table 9
Summary of 360-Scores, Associates

Year	Mean, Men	Standard Deviation, Men	Mean, Women	Standard Deviation, Women
2003	3.93	0.41	3.88	0.40
2004	3.99	0.39	3.96	0.36
2005	3.87	0.45	3.79	0.47
2006	4.02	0.31	4.01	0.29
2007	4.12	0.29	4.07	0.31
2008	4.28	0.26	4.28	0.24
2009	4.40	0.29	4.39	0.23
2010	7.70	0.56	7.59	0.56
2011	8.10	0.43	8.00	0.42
2012	8.23	0.38	8.19	0.37
2013	8.33	0.39	8.32	0.36
2014	8.36	0.39	8.32	0.38
2015	8.44	0.36	8.38	0.40

The sample for this table includes employees in the New York class from 2003 to 2015, and nationally from 2005 to 2015; it is limited to employees for whom all regression control variables, including the peformance-review variables, are non-missing.

The underlying range for the 360 score was 1-5 from 2003 to 2009, and 1-9 from 2010 to 2015. Goldman stopped using this metric after 2015.

Table 10
Summary of 360-Scores, Vice Presidents

Year	Mean, Men	Standard Deviation, Men	Mean, Women	Standard Deviation, Women
2003	3.95	0.41	3.79	0.34
2004	4.05	0.36	4.00	0.34
2005	4.11	0.42	4.01	0.41
2006	4.16	0.25	4.12	0.26
2007	4.22	0.24	4.18	0.26
2008	4.32	0.23	4.30	0.22
2009	4.45	0.24	4.41	0.23
2010	7.80	0.46	7.74	0.48
2011	8.17	0.33	8.10	0.33
2012	8.29	0.30	8.20	0.32
2013	8.38	0.29	8.29	0.32
2014	8.38	0.30	8.31	0.32
2015	8.45	0.27	8.37	0.28

The sample for this table includes employees in the New York class from 2003 to 2015, and nationally from 2005 to 2015; it is limited to employees for whom all regression control variables, including the peformance-review variables, are non-missing.

The underlying range for the 360 score was 1-5 from 2003 to 2009, and 1-9 from 2010 to 2015. Goldman stopped using this metric after 2015.

Table 11
Regression Analysis of the Male/Female 360-Score Difference, Associates

Panel A: 2003-2009

	Difference	T-Ratio	Employee-Years in Sample	Adjusted R-squared
Model	[1]	[2]	[3]	[4]
Model 360-1	-0.022	1.52	4,779	0.001
Model 360-2	-0.051	4.16	4,779	0.341
Model 360-3	-0.065	5.50	4,618	0.401

Panel B: 2010-2015

	Difference	T-Ratio	Employee-Years in Sample	Adjusted R-squared
Model	[1]	[2]	[3]	[4]
Model 360-1	-0.057	2.68	4,669	0.003
Model 360-2	-0.054	4.13	4,669	0.569
Model 360-3	-0.051	3.89	4,669	0.589

The table gives an absolute value of the t-ratio for the test of no difference in average 360 score between men and women. Generally speaking, a t-ratio with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. T-ratios were calculated using robust standard errors clustered by individual employee. Negative differences indicate that women receive average 360 scores that are lower, on average, than those of men who have the same levels of characterics included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

Model 360-1 is the difference between the average overall 360 score of men and women. It is included for reference.

Model 360-2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model 360-3 includes all the same variables as Model 2 and, in addition, Business Unit. It is limited to the years 2004 through 2018, the period of time over which I have information on Business Units in each division.

The underlying range for the 360 score was 1-5 from 2003 to 2009, and 1-9 from 2010 to 2015. Goldman stopped using this metric after 2015.

Table 12
Regression Analysis of the Male/Female 360-Score Difference, Vice Presidents

Panel A: 2003-2009

	Difference	T-Ratio	Employee-Years in Sample	Adjusted R-squared
Model	[1]	[2]	[3]	[4]
Model 360-1	-0.048	3.99	8,620	0.004
Model 360-2	-0.055	5.28	8,620	0.284
Model 360-3	-0.064	6.23	8,207	0.300

Panel B: 2010-2015

	Difference	T-Ratio	Employee-Years in Sample	Adjusted R-squared
Model	[1]	[2]	[3]	[4]
Model 360-1	-0.056	4.13	11,488	0.003
Model 360-2	-0.048	5.17	11,488	0.557
Model 360-3	-0.056	6.10	11,488	0.588

The table gives an absolute value of the t-ratio for the test of no difference in average 360 score between men and women. Generally speaking, a t-ratio with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. T-ratios were calculated using robust standard errors clustered by individual employee. Negative differences indicate that women receive average 360 scores that are lower, on average, than those of men who have the same levels of characterics included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

Model 360-1 is the difference between the average overall 360 score of men and women. It is included for reference.

Model 360-2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model 360-3 includes all the same variables as Model 2 and, in addition, Business Unit. It is limited to the years 2004 through 2018, the period of time over which I have information on Business Units in each division.

The underlying range for the 360 score was 1-5 from 2003 to 2009, and 1-9 from 2010 to 2015. Goldman stopped using this metric after 2015.

Table 13
Comparison of Male and Female Total Earnings by Quartile, Associates

Quartile	Mean Earnings, Men	Mean Earnings, Female	$ Difference	T-Ratio for $ Difference	% Difference
1	$411,745	$316,943	-$94,803	-4.81	-23.0%
2/3	$260,942	$244,478	-$16,464	-3.63	-6.3%
4/5	$182,728	$185,133	$2,405	0.66	1.3%

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing. Earnings for part-year workers are adjusted to a full-year equivalent level.

Table 14
Comparison of Male and Female Total Earnings by Quartile, Vice Presidents

Quartile	Mean Earnings, Men	Mean Earnings, Female	$ Difference	T-Ratio for $ Difference	% Difference
1	$1,029,362	$667,302	-$362,060	-13.27	-35.2%
2/3	$628,450	$472,717	-$155,733	-14.96	-24.8%
4/5	$436,950	$335,999	-$100,951	-9.37	-23.1%

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing. Earnings for part-year workers are adjusted to a full-year equivalent level.

Note, the T-ratio in Column [4] is for the level difference in earnings.

Table 15
Regression Analysis of the Male/Female Pay Difference, Associates

	Log-Point Difference	T-Ratio	Percent Difference	Employee-Years in Sample	Adjusted R-squared	Percent of Pay Gap Explained by Performance Metrics
Model	[1]	[2]	[3]	[4]	[5]	[6]
Model 2a	-0.054	4.59	-5.22%	11,976	0.328	
Model 2b	-0.044	4.20	-4.29%	11,976	0.443	17.79%
Model 2c	-0.031	3.13	-3.10%	11,976	0.453	40.64%
Model 2d	-0.032	3.30	-3.19%	11,976	0.487	38.86%
Model 3a	-0.037	3.53	-3.64%	11,815	0.471	
Model 3b	-0.027	2.97	-2.64%	11,815	0.589	27.48%
Model 3c	-0.013	1.41	-1.29%	11,815	0.560	64.62%
Model 3d	-0.016	1.86	-1.61%	11,815	0.608	55.75%

The table gives an absolute value of the T-Ratio for the test of no difference in earnings between men and women. Generally speaking, a T-Ratio with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. T-Ratios were calculated using robust standard errors clustered by individual employee. Negative differences indicate that women receive earnings that are lower, on average, than those of men who have the same levels of characterics included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

Model 2a controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year. It differes from Model 2 only in the restriction of the sample to employees with non-missing performance reviews.

Model 2b includes all the same variables as Model 2 and, in addition, quartile.

Model 2c includes all the same variables as Model 2 and, in addition, average 360-score (which is defined from 2003 to 2015) and overall manager rating (which is defined from 2016 to 2018).

Model 2d includes all the same variables as Model 2 and, in addition, quartile, average 360-score, and overall manager rating.

Models 3a through 3d are parallel to Models 2a through 2d, but adds controls for Business Units. These analyses are limited to the years 2004 through 2018, the period of time over hiwh I hae information on Business Unit in each division.

The percentage explained by performance ratings in Column [6] is equal to (A-X)/A, where A is the percentage pay gap in Model 2a or 3a and X is percentage pay gap for the given model.

Table 16
Regression Analysis of the Male/Female Pay Difference, Vice Presidents

	Log-Point Difference	T-Ratio	Percent Difference	Employee-Years in Sample	Adjusted R-squared	Percent of Pay Gap Explained by Performance Metrics
Model	[1]	[2]	[3]	[4]	[5]	[6]
Model 2a	-0.261	13.46	-22.98%	26,036	0.218	
Model 2b	-0.235	13.10	-20.93%	26,036	0.360	8.93%
Model 2c	-0.226	12.43	-20.21%	26,036	0.322	12.08%
Model 2d	-0.222	12.52	-19.88%	26,036	0.383	13.52%
Model 3a	-0.248	13.30	-21.96%	25,623	0.369	
Model 3b	-0.219	13.15	-19.70%	25,623	0.510	10.29%
Model 3c	-0.210	12.18	-18.91%	25,623	0.460	13.87%
Model 3d	-0.206	12.52	-18.64%	25,623	0.526	15.10%

The table gives an absolute value of the T-Ratio for the test of no difference in earnings between men and women. Generally speaking, a T-Ratio with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. T-Ratios were calculated using robust standard errors clustered by individual employee. Negative differences indicate that women receive earnings that are lower, on average, than those of men who have the same levels of characterics included in the model.

The sample for this table includes employees in the New York class from 2003 to 2018, and nationally from 2005 to 2018; it is limited to employees for whom the relevant control variables, including the peformance-review variables, are non-missing.

Model 2a controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year. It differes from Model 2 only in the restriction of the sample to employees with non-missing performance reviews.

Model 2b includes all the same variables as Model 2 and, in addition, quartile.

Model 2c includes all the same variables as Model 2 and, in addition, average 360-score (which is defined from 2003 to 2015) and overall manager rating (which is defined from 2016 to 2018).

Model 2d includes all the same variables as Model 2 and, in addition, quartile, average 360-score, and overall manager rating.

Models 3a through 3d are parallel to Models 2a through 2d, but adds controls for Business Units. These analyses are limited to the years 2004 through 2018, the period of time over hiwh I hae information on Business Unit in each division.

The percentage explained by performance ratings in Column [6] is equal to (A-X)/A, where A is the percentage pay gap in Model 2a or 3a and X is percentage pay gap for the given model.

Table 17

Panel A: Number of Person-Years by Overall Manager Rating, Associates, 2016-2018

Rating	Male	Percent, Male	Female	Percent, Female
Outstanding	1,241	68.2%	514	72.6%
Good	492	27.0%	167	23.6%
Needs Improvement	87	4.8%	27	3.8%

Panel B: Number of Person-Years by Overall Manager Rating, Vice Presidents, 2016-2018

Quartile	Male	Percent, Male	Female	Percent, Female
Outstanding	3,130	71.3%	1,086	70.7%
Good	1,174	26.7%	420	27.3%
Needs Improvement	87	2.0%	31	2.0%

The sample for this table includes employees in class from 2016 to 2018; it is limited to employees for whom all relevant control variables, including the peformance-review variables, are non-missing.

Among Associates, a chi-squared test for the equality of Overall Manger Rating across genders yields a test statistic of 4.8 with an associated p-value of .09

Among Vice Presidents, a chi-squared test for the equality of Overall Manger Rating across genders yields a test statistic of 0.2 with an associated p-value of .897

Table 18

Panel A: Number of Person-Years by Quartile, Associates, 2016-2018

Quartile	Male	Percent, Male	Female	Percent, Female
1	498	27.4%	211	29.8%
2/3	954	52.4%	389	54.9%
4/5	368	20.2%	108	15.3%

Panel B: Number of Person-Years by Quartile, Vice Presidents, 2016-2018

Quartile	Male	Percent, Male	Female	Percent, Female
1	1,127	25.7%	409	26.6%
2/3	2,239	51.0%	784	51.0%
4/5	1,025	23.3%	344	22.4%

The sample for this table includes employees in class from 2016 to 2018; it is limited to employees for whom all relevant control variables, including the peformance-review variables, are non-missing.

Among Associates, a chi-squared test for the equality of quartile across genders yields a test statistic of 8.4 with an associated p-value of .015

Among Vice Presidents, a chi-squared test for the equality of quartile across genders yields a test statistic of 0.8 with an associated p-value of .654

Table 19

Panel A: Probit Regression Analysis of the Male/Female Reception of the Outstanding Rating, 2016-2018, Associates

	Regression Coefficient	T-Ratio	Marginal Effect	Z-Score	Employee-Years in Sample
Model	[1]	[2]	[3]	[4]	[5]
Model 1	0.128	1.838	0.045	1.843	2,528
Model 2	0.095	1.350	0.029	1.351	2,522
Model 3	0.114	1.519	0.033	1.521	2,498

Panel B: Probit Regression Analysis of the Male/Female Placement in the Top Quartile, 2016-2018, Associates

	Regression Coefficient	T-Ratio	Marginal Effect	Z-Score	Employee-Years in Sample
Model	[1]	[2]	[3]	[4]	[5]
Model 1	0.072	1.043	0.024	1.044	2,528
Model 2	0.052	0.738	0.017	0.738	2,522
Model 3	0.030	0.405	0.010	0.406	2,499

The table gives an absolute value of the Z-score for the test of no difference in the top quartile placement between men and women in a probit regression. A Z-score with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. Z-scores were calculated using standard errors clustered by individual. The marginal effect is the discrete difference between females and males in the probability of being in the top quartile implied by the regression coefficients in column [1]. A negative marginal effect implies that females are less likely to be in the top quartile than males accounting for the factors included in the model.

The sample for this table includes employees in class from 2016 to 2018; it is limited to employees for whom all relevant control variables, including the peformance-review variables, are non-missing.

Model 1 Concerns the raw difference in each performance metric. It is included for reference.

Model 2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model 3 includes all the same variables as Model 2 and, in addition, business unit.

Note that the coefficients in a probit model are related to a change in the probability of each binary outcome, so it is not possible to estimate a coefficient for a variable that is associated with only one outcome. Consequently, the corresponding observations must be dropped from the model. Therefore, even though Model 1 is limited to observations for which control variables are available, I must drop some of those observations in Models 2 and 3, resulting in a different observation count across rows.

Table 20

Panel A: Probit Regression Analysis of the Male/Female Reception of the Outstanding Rating, 2016-2018, Vice Presidents

	Regression Coefficient	T-Ratio	Marginal Effect	Z-Score	Employee-Years in Sample
Model	[1]	[2]	[3]	[4]	[5]
Model 1	-0.018	0.355	-0.006	0.355	5,928
Model 2	-0.035	0.660	-0.011	0.660	5,921
Model 3	-0.011	0.199	-0.003	0.199	5,872

Panel B: Probit Regression Analysis of the Male/Female Placement in the Top Quartile, 2016-2018, Vice Presidents

	Regression Coefficient	T-Ratio	Marginal Effect	Z-Score	Employee-Years in Sample
Model	[1]	[2]	[3]	[4]	[5]
Model 1	0.029	0.538	0.009	0.538	5,928
Model 2	0.015	0.273	0.005	0.273	5,914
Model 3	-0.007	0.118	-0.002	0.118	5,909

The table gives an absolute value of the Z-score for the test of no difference in the top quartile placement between men and women in a probit regression. A Z-score with an absolute value of 1.96 or higher indicates that the difference is statistically significantly different from zero at the five percent significance level. Z-scores were calculated using standard errors clustered by individual. The marginal effect is the discrete difference between females and males in the probability of being in the top quartile implied by the regression coefficients in column [1]. A negative marginal effect implies that females are less likely to be in the top quartile than males accounting for the factors included in the model.

The sample for this table includes employees in class from 2016 to 2018; it is limited to employees for whom all relevant control variables, including the peformance-review variables, are non-missing.

Model 1 Concerns the raw difference in each performance metric. It is included for reference.

Model 2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

Model 3 includes all the same variables as Model 2 and, in addition, business unit.

Note that the coefficients in a probit model are related to a change in the probability of each binary outcome, so it is not possible to estimate a coefficient for a variable that is associated with only one outcome. Consequently, the corresponding observations must be dropped from the model. Therefore, even though Model 1 is limited to observations for which control variables are available, I must drop some of those observations in Models 2 and 3, resulting in a different observation count across rows.

Table 21

Panel A: Summary of Compensation by Performance-Rating Regime , Associates

Group		Average Male Pay [1]	Average Female Pay [2]	Difference [3]	Percentage Difference = [3]/[1] [4]	N [5]	Percent Female [6]
All employees-years, 2003-2015 ratings regime	[1]	$296,803	$253,278	-$43,524	-14.66%	9448	28.2%
All employee-years, 2016-2018 ratings regime	[2]	$245,790	$238,749	-$7,041	-2.86%	2528	28.0%
All employee-years	[3]	$286,017	$250,224	-$35,793	-12.51%	11976	28.1%

Panel B: Summary of Compensation by Performance-Rating Regime , Vice Presidents

Group		Average Male Pay [1]	Average Female Pay [2]	Difference [3]	Percentage Difference = [3]/[1] [4]	N [5]	Percent Female [6]
All employees-years, 2003-2015 ratings regime	[1]	$725,851	$518,245	-$207,606	-28.60%	20108	21.5%
All employee-years, 2016-2018 ratings regime	[2]	$580,866	$405,022	-$175,844	-30.27%	5928	25.9%
All employee-years	[3]	$694,282	$488,599	-$205,683	-29.63%	26036	22.5%

Rows [1] and [2] of each panel are based on all employee-years, in the given time range, that are not missing any of the model control variables, including peformance metrics. Rows [3] pools all employee-years with non-missing control variables.

Table 22

Panel A: Regression Analysis of Pay Gap Persistence Since 2016, Associates

		Female Coefficient, Old Ratings Regime (2003-2015)	T-Ratio	Percent	Female Coefficient, New Ratings Regime (2016-2018)	T-Ratio	Percent	N	Adjusted R-squared
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Model 1	[1]	-0.080	4.31	-7.7%	-0.005	0.27	-0.5%	11,976	0.003
Model 2	[2]	-0.066	4.73	-6.4%	-0.006	0.41	-0.6%	11,976	0.328
Model 3	[3]	-0.048	3.85	-4.7%	0.002	0.13	0.2%	11,815	0.472

Panel B: Regression Analysis of Pay Gap Persistence Since 2016, Vice Presidents

		Female Coefficient, Old Ratings Regime (2003-2015)	T-Ratio	Percent	Female Coefficient,New Ratings Regime (2016-2018)	T-Ratio	Percent	N	Adjusted R-squared
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Model 1	[1]	-0.277	11.78	-24.2%	-0.330	11.95	-28.1%	26,036	0.037
Model 2	[2]	-0.252	11.95	-22.3%	-0.288	11.21	-25.0%	26,036	0.218
Model 3	[3]	-0.233	11.59	-20.8%	-0.290	11.52	-25.2%	25,623	0.369

This pay regressions in this table estimate seperate gender coefficients for employees in the old ratings regime (2003-2015) and the new ratings regimes (2016-2018). For each coefficient, this tables reports the absolute value of the T-ratio for the test of no difference in earnings between men and women. Generally speaking, if the p-value is less than 0.05, the coefficients are considered different at the 5% level of statistical significance.

Model 1 is the difference between the average earnings of men and women. It is included for reference.

Model 2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new

Model 3 includes all the same variables as Model 2 and, in addition, Business Unit. This analysis is limited to the years 2004-2018, the period of time over which I have information on Business Units in each division.

Table 23
Percent of Observations in 2016-2018 with Performance Reviews Prior to 2016

Number of Years of Performance Review Available Prior to 2016	Percent of Corresponding Associate Observations in 2016-2018	Percent of Corresponding Vice President Observations in 2016-2018
0	75%	33%
1	15%	11%
2	7%	10%
3	2%	8%
4	1%	11%
5 or more	0%	27%

Mean Years of Performance Review Available Prior to 2016	Associates	Vice Presidents
	0.40	2.32

Table 24
Comparison of Actual and Expected Promotion Rates to Managing Direction

					Bootstrap			
Number of Men [1]	Promotion Rate, Men [2]	Number of Women [3]	Promotion Rate, Women [4]	Promotions, Women [5]	Expected Promotions, Women [6]	Shortfall [7]	Expected Promotions 2.5 Percentile, Women [8]	Expected Promotions 97.5 Percentile, Women [9]
23142	3.87%	6626	3.08%	204	229.52	25.52	215	245

Note:
Only promotions that are both to the an in-class division as well as in the US have been tracked.

Expected promotion rate for women (and the resulting shortfall) is calculated using a probit regression model for men only and calculating the probability of promotion for women using men's coefficients. The model controls for tenure at Goldman (and the square of tenure), tenure as Vice President at Goldman (and the square of tenure as VP), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, and year. Note when coding education BA, associates and some college have been assigned to a single category.

Job groups with fewer than 150 observations in the relevant sample are combined into an expanded "Other" group.

Table 25
Damage Summary Model Comparison

	Total In-class Compensation [1]	Percent Difference [2]	Pay-gap Factor [3]	Damages [4]	Percent Difference After Accounting for Performance Metrics [5]	Pay-gap Factor for Performance [6]	Damages Explained by Performance Metric [7]
Associates	$831,528,425	5.22%	5.51%	$45,823,586	3.19%	2.14%	$17,808,316
Vice Presidents	$4,218,279,586	22.98%	29.84%	$1,258,916,617	19.88%	4.04%	$170,230,036
Total	$5,049,808,011			$1,304,740,203			$188,038,352

Notes
Associate total in-class compensation runs through 2015. Vice President total in-class compensation projected through June of 2021.

Model 2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AA job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

[1] Associate total in-class compensation runs through 2015. Vice President total in-class compensation projected through June of 2021.
[2] The absolute value of the Percent Difference from Model 2d from Table 15 for Associates and Table 16 for Vice Presidents.
[3] = [2]/(1-[2])
[4] = [1] x [3] .
[5] The absolute value of the Percent Difference from Model 2d from Table 15 for Associates and Table 16 for Vice Presidents.
[6] = (1-[5]) / (1-[2]) - 1
[7] = [6] x [1]

Table 26
Damage Summary Sample Specification Comparison

Full Sample

	Total In-class Compensation [1]	Percent Difference [2]	Pay-gap Factor [3]	Damages [4]	Percent Difference After Accounting for Performance Metrics [5]	Pay-gap Factor for Performance [6]	Damages Explained by Performance Metric [7]
Associates	$831,528,425	5.22%	5.51%	$45,823,586	3.19%	2.14%	$17,808,316
Vice Presidents	$4,218,279,586	22.98%	29.84%	$1,258,916,617	19.88%	4.04%	$170,230,036
Total	$5,049,808,011			$1,304,740,203			$188,038,352

Damages for Full Sample less Exclusion Group 1 (Excluding Opt Outs, Pre-Complaint Severance Agreements, and Pre-Complaint MD Agreements)

Associates	$693,941,835	5.22%	5.51%	$38,241,511	3.19%	2.14%	$14,861,711
Vice Presidents	$3,507,422,167	22.98%	29.84%	$1,046,766,095	19.88%	4.04%	$141,543,155
Total	$4,201,364,002			$1,085,007,606			$156,404,866

Damages for Full Sample less Exclusion Group 2 (Excluding Severance Agreement, MD Agreement, Private Wealth Management Agreement, Exclusion Group 1)

Associates	$568,817,240	5.22%	5.51%	$31,346,187	3.19%	2.14%	$12,181,997
Vice Presidents	$2,461,606,082	22.98%	29.84%	$734,649,456	19.88%	4.04%	$99,338,909
Total	$3,030,423,322			$765,995,643			$111,520,906

Notes
[1] shows the total compensation for the given sample.
[2] The absolute value of the Percent Difference from Model 2d from Table 15 for Associates and Table 16 for Vice Presidents.
[3] = [2]/(1-[2])
[4] = [1] x [3]
[5] The absolute value of the Percent Difference from Model 2d from Table 15 for Associates and Table 16 for Vice Presidents.
[6] = (1-[5]) / (1-[2]) - 1
[7] = [6] x [1]

Full Sample includes all women who meet the class requirements specified in my report.
Exclusion Group 1 removes from Full Sample women who signed a Severance Agreement or MD Agreement prior to the filing of the complaint as well as women who opted out of the class by the opt-out deadline.
Exclusion Group 2 removes from the Full Sample both Exclusion Group 1 and women who signed a Severance Agreement, MD, or PWA Agreement at any point in time

Table 27
Total Value of Raises Necessary to Bring Female Vice Presidents to Pay Parity

	One-Year total PATC [1]	Percent Difference [2]	Pay-gap Factor [3]	Damages [4]	Percent Difference After Accounting for Performance Metrics [5]	Pay-gap Factor for Performance [6]	Damages Explained by Performance Metric [7]
Vice Presidents	$227,135,284	22.98%	29.84%	$67,786,968	19.88%	4.04%	$9,166,118

Note:
Model 2 controls for tenure at Goldman (and the square of tenure), related prior experience (and the square of related prior experience), division, AAP job group, employee's office (city), education (highest degree), whether employee is a lateral hire, whether employe is a new lateral hire, and year.

[1] is based the sum of PATC for all Vice Presidents in class at the end of the final year of data available, 2018.
[2] The absolute value of the Percent Difference from Model 2d from Table 15 for Associates and Table 16 for Vice Presidents.
[3] = [2]/(1-[2])
[4] = [1] x [3] .
[5] The absolute value of the Percent Difference from Model 2d from Table 16.
[6] = (1-5]) / (1-[2]) - 1
[7] = [6] x [1]

Table 28: Estimated Promotion Shortfall by Year

Missed Promotion Year	Promotions, Women [1]	Expected Promotions, Women [2]	Promotions Shortfall, Women [3]
2002 *	10	11.06	1.06
2003	10	11.06	1.06
2004	10	10.47	0.47
2005	13	19.54	6.54
2006	0	0.00	0.00
2007	28	41.04	13.04
2008	0	0.00	0.00
2009	15	18.32	3.32
2010	23	19.33	-3.67
2011	13	15.23	2.23
2012	21	17.71	-3.29
2013	14	14.78	0.78
2014	0	0.00	0.00
2015	29	28.07	-0.93
2016	0	0.00	0.00
2017	28	33.97	5.97
2018	0	0.00	0.00
Total	214	240.59	26.59
Total Excl. 2002	204	229.52	25.52

Notes:
There were no observed promotions to EMD in 2014, 2016, and 2018.
This table presents the yearly promotion shortfall estimates from the
[1] Observed promotions among women

[2] Expected promotions among women
[3] = [2] - [1]

Table 29: Promotion Damage Summary

Year	Value of a Missed Promotion in Given Year [1]	Promotions Shortfall, Women [2]	Damages [3]
2002 *	$9,831,150	1.06	$10,466,862
2003	$9,831,150	1.06	$10,458,299
2004	$9,460,886	0.47	$4,480,723
2005	$8,014,927	6.54	$52,388,296
2006	$7,481,311	0.00	$0
2007	$6,891,880	13.04	$89,898,034
2008	$5,795,359	0.00	$0
2009	$5,472,420	3.32	$18,155,509
2010	$5,513,890	-3.67	-$20,209,835
2011	$4,654,696	2.23	$10,360,115
2012	$4,300,181	-3.29	-$14,158,466
2013	$3,404,128	0.78	$2,664,520
2014	$2,829,842	0.00	$0
2015	$2,412,115	-0.93	-$2,254,281
2016	$1,961,981	0.00	$0
2017	$1,456,323	5.97	$8,698,945
2018	$888,292	0.00	$0
Total		26.59	$170,948,720
Total Excl. 2002		25.52	$160,481,858

Sources: 'GS CCO - Summary of EMD PATC - 20180913.xlsx' and 'GS CCO Summary of EMD Prom Term - 20180913.xlsx'

Notes:
There were no (observed) promotions to EMD in 2014, 2016, and 2018.
[1] Amount of money associated with a single foregone promotion from VP to EMD, valued through June of 2021. This multiplies the difference between the 90th percentile of VP pay and average total EMD pay by the probability that she remains as an EMD (or in a higher-earning role) at Goldman through June 2021. Each year there is assumed to be an 11% chance she leaves Goldman, which is the average annual EMD attrition rate.

[2] corresponds with the shortfall in column [3] presented in Table 28
[3] = [1] * [2]

* I have been instructed by counsel to assume that the promotions shortfall in 2002 is equal to the shortfall in 2003

Table 30: Promotion Damage Sample Specification Comparison

Missed Promotion Year	Value of a Missed Promotion in Given Year [1]	Promotions Shortfall, Women [2]	Damages, Full Sample [3]	Percent of Total Person-Years not in Exclusion Group 1 [4a]	Damages, Exclusion Group 1 [4]	Percent of Total Person-Years not in Exclusion Group 2 [5a]	Damages, Exclusion Group 2 [5]
2002 *	$9,831,150	1.06	$10,458,299	71.71%	$7,499,365	53.66%	$5,611,770
2003	$9,831,150	1.06	$10,458,299	71.71%	$7,499,365	53.66%	$5,611,770
2004	$9,460,886	0.47	$4,480,723	67.92%	$3,043,510	50.94%	$2,282,632
2005	$8,014,927	6.54	$52,388,296	69.85%	$36,593,616	52.54%	$27,523,403
2006	$7,481,311	0.00	$0	67.87%	$0	48.20%	$0
2007	$6,891,880	13.04	$89,898,034	68.45%	$61,531,137	48.26%	$43,384,666
2008	$5,795,359	0.00	$0	78.06%	$0	55.87%	$0
2009	$5,472,420	3.32	$18,155,509	90.19%	$16,373,668	67.11%	$12,183,935
2010	$5,513,890	-3.67	-$20,209,835	92.52%	-$18,697,877	68.08%	-$13,758,815
2011	$4,654,696	2.23	$10,360,115	92.07%	$9,538,725	70.33%	$7,286,526
2012	$4,300,181	-3.29	-$14,158,466	91.98%	-$13,022,950	70.68%	-$10,006,736
2013	$3,404,128	0.78	$2,664,520	92.03%	$2,452,047	74.35%	$1,981,162
2014	$2,829,842	0.00	$0	92.29%	$0	76.27%	$0
2015	$2,412,115	-0.93	-$2,254,281	92.08%	-$2,075,765	75.14%	-$1,693,824
2016	$1,961,981	0.00	$0	91.55%	$0	78.69%	$0
2017	$1,456,323	5.97	$8,698,945	90.71%	$7,891,186	78.75%	$6,850,419
2018	$888,292	0.00	$0	91.68%	$0	83.92%	$0
Total		26.59	$170,940,157		$118,626,028		$87,256,910
Total Excl. 2002		25.52	$160,481,858		$111,126,662		$81,645,140

Sources: 'GS CCO - Summary of EMD PATC - 20180913.xlsx' and 'GS CCO Summary of EMD Prom Term - 20180913.xlsx'

Notes:
There were no observed promotions to EMD in 2014, 2016, and 2018.
[1] Amount of money associated with a single foregone promotion from VP to EMD, valued through June of 2021. This multiplies the difference between the 90th percentile of VP pay and average total EMD pay by the probability that she remains as an EMD (or in a higher-earning role) at Goldman through June 2021. Each year there is assumed to be an 11% chance she leaves Goldman, which is the average annual EMD attrition rate.

[2] corresponds with the shortfall [3] presented in Table [[26]].
[3] = [1] * [2]
[4a] the percentage of female person-years eligible promotions in the group of people not in Exclusion Group 1.
[4] = [3] x [4a]
[5a] the percentage of female person-years eligible for promotions in the group of people not in Exclusion Group 2.
[5] = [3] x [5a]

Exclusion Group 1 removes from Full Sample women who signed a Severance Agreement or MD Agreement prior to the filing of the complaint as well as women who opted out of the class by the opt-out deadline.

Exclusion Group 2 removes from the Full Sample both Exclusion Group 1 and women who signed a Severance Agreement, MD, or PWA Agreement at any point in time.

* I have been instructed by counsel to assume that the promotions shortfall in 2002 is equal to the shortfall in 2003

Appendix A

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Education

Rensselaer Polytechnic Institute, BS (Economics), 1972
Cornell University, MS (Industrial and Labor Relations), 1974
Princeton University, Ph.D. (Economics), 1977

Current Employment

Princeton University
Professor of Economics, 1991-1995.
Hughes-Rogers Professor of Economics, 1995-present.
Director, Industrial Relations Section, 2013-2017.

Major Fields of Interest

Labor Economics Econometrics Law and Economics Industrial Organization

Honorific Fellowships, Prizes, and Professional Offices

Jacob Mincer Prize for Lifetime Contributions to the Field of Labor Economics, Society of Labor Economists, 2018.
President, Society of Labor Economists, 2016-17.
Fellow, Labor and Employment Relations Association, named 2009.
Fellow, Society of Labor Economists, elected 2004.
Fellow, Econometric Society, elected 1988.
Richard E. Quandt Teaching Prize, Department of Economics, Princeton University, June 2000 and June 2011.
Prize from American Law and Economics Association for best paper in the *American Law and Economics Review* in 2013. Awarded in 2014 for "Why do Plaintiffs Lose Appeals? Biased Trial Courts, Litigious Losers, or Low Trial Win Rates?"
Edwin E. Ghiselli Award for Research Design, American Psychological Association, Division 14, 1984. (with Max H. Bazerman)

Other Current Appointments

Faculty Associate, Industrial Relations Section, Princeton University, 1991-present.
Research Associate, National Bureau of Economic Research, 1982-.
Research Fellow, Institute for the Study of Labor (IZA), Bonn, 2006-.
Affiliated Faculty, Kahneman-Treisman Center for Behavioral Science and Public Policy, Princeton University, 2016-.
Faculty Associate, Program in Political Economy, Princeton University, 1993-.

Other Current Appointments (cont'd)

Faculty Associate, Program in Applications of Computing, Princeton University, 1996-.
Faculty Associate, Center for the Study of Social Organization, Princeton University, 2008-.
Editorial Board, Journal of Labor Abstracts, 1996-.
Associate Editor, Journal of Empirical Legal Studies, 2004-.
Labour Statistics Advisory Committee, Statistics Canada, 2003-.
Executive and Supervisory Committee (ESC) of CERGE-EI, Prague, 2005-2009, 2011-.
International Affiliate, Canadian Labour Market and Skills Researcher Network, 2011-.

Past Positions

Professor (1986-1991), Associate Professor (1981-1986), Assistant Professor (1977-1981), Department of Economics, Massachusetts Institute of Technology.
Institute for Advanced Study, School of Social Science. Member, September 2006 - August 2007. Visitor, September 2010 - August 2011.
Russell Sage Foundation, Visiting Scholar, September 2002 - July 2003.
Fellow, Center for Advanced Study in the Behavioral Sciences, 1983-1984 and 1989-1990.
Harvard University, Visiting Professor of Economics, Fall 2014, Fall 2018.
Director, Industrial Relations Section, Princeton University, July 1993-December 1993, July 1995-June 1998, July 2003 – June 2004, July 2013 – June 2017.
Associate Editor, Industrial and Labor Relations Review, 1999–2004.
Associate Editor, Quarterly Journal of Economics, 1984-1989.
Editorial Board, American Economic Review, 1988–1991.
Social Science Research Council Advisory Group on a 1986 Quality of Employment Survey, 1985-86.
Visiting Fellow, University of Warwick, Summer 1982.
Member, Visiting Committee, Department of Economics, Princeton University, 1979-1990.
Member, Nominating Committee, Industrial Relations Research Association, 1990.
Co-Director, Summer Institute on Negotiation and Dispute Resolution, Center for Advanced Study in the Behavioral Sciences, Summer 1992.
John M. Olin Fellow, Cornell Law School, February 1994 and October 1994.
Member, Peer Review Panel, National Science Foundation Economics Program, Spring 1992, Spring 1994-Spring 1995.
Editorial Board, Industrial and Labor Relations Review, 1994-1999.
Member, Peer Review Panel, National Science Foundation Behavioral Sciences Infrastructure Competition, Spring 1999.
Member, Committee on the Status of Women in the Economics Profession, 1996-2000
Technical Review Committee, National Longitudinal Surveys, 1996-2004.
Social Science External Advisory Council, Cornell University, 2006-2008.
Member, Committee on Honors and Awards, American Economics Association, 2013-2014.

Past Positions (cont'd)

Visiting Scholar, Centre for Economic Performance (CEP), London School of Economics, March 2015.

Visiting Scholar, Centre de Rescherche en Économie et Statistique (CREST), Paris, May 2015

Visiting Scholar, Centre for Research and Analysis of Migration (CReAM), University College London, March 2019.

Membership in Professional Societies

American Economic Association	Econometric Society (Fellow)
American Law and Economics Association	Labor and Employment Relations Association (Fellow)
American Statistical Association	Society of Labor Economists (Fellow)

Fellowships, Grants, and Contracts

National Science Foundation, Grant No. SES-7924880 to Massachusetts Institute of Technology, "Economics of Labor Unions," 1/80-6/82.

U.S. Department of Labor, Minimum Wage Study Commission, Contract No. J9E-00113 to Massachusetts Institute of Technology, "Union Wages and the Minimum Wage," 9/80-2/81.

Alfred P. Sloan Research Fellowship, Alfred P. Sloan Foundation, 9/81-8/85.

National Science Foundation, Grant No. SES-8207703 to Massachusetts Institute of Technology, "An Analysis of the Unionization Process in the United States," 7/82-6/83.

National Science Foundation, Grant No. SES-8408623 to National Bureau of Economic Research, "Threat Effects and the Extent of Unionization in the United States," 7/84-12/86.

National Science Foundation, Grant No. SES-8605530 to National Bureau of Economic Research, "The Political Economy of Labor Unions," 8/86-12/88.

National Science Foundation, Grant No. SES-8912664 to National Bureau of Economic Research, "Empirical Analysis of Inter-Firm Worker Mobility," 7/89-6/92.

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Union de Trabajadores de la Industria Electrica y Riego, Inc. (UTIER), v. Puerto Rico Electric Power Authority (PREPA), et al.

Testimony: Review of damages model of plaintiffs' expert

Jurisdiction: United States District Court
District of Puerto Rico

Caption: Case No. 17 BK 3283-LTS

Deposition: December 2020

Chen Oster et al., v. Goldman, Sachs & Co. and The Goldman Sachs Group, Inc.

Testimony: Economic and statistical analysis of alleged discrimination in pay and promotions among female Associates and Vice Presidents.

Jurisdiction: United States District Court
Southern District of New York

Caption: Case 1:10-cv-06950

Retained by: Plaintiffs

Deposition: August 2018

Katherine Moussouris et al., v. Microsoft Corporation

Testimony: Economic and statistical analysis of alleged discrimination in pay and promotions among female technical employees

Jurisdiction: United States District Court
Western District of Washington

Caption: Case 2:15-cv-01483-JLR

Retained by: Plaintiffs

Deposition: December 2017

New York State Division of Human Rights v. International Longshoremen's Association, New York Shipping Association, et al.

Testimony:	Economic and statistical analysis of alleged exclusion of certain applicants from union membership and employment as longshore workers on the basis of race, ethnicity, or sex.
Jurisdiction:	State of New York Division of Human Rights
Caption:	Case No. 10156672
Retained by:	International Longshoremen's Association AFL-CIO and New York Shipping Association, Inc. (Respondents)
Hearing:	November 2017

Appendix B

Documents Relied On

Case Documents

Second Amended Class Action Complaint, H. Christina Chen-Oster, Shanna Orlich, Allison Gamba, and Mary De Luis v. Goldman Sachs & Co. and The Goldman Sachs Group, Inc., August 3, 2015

Opinion and Order, Chen-Oster et al., v. Goldman Sachs 10-cv-06950-AT-RWL

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